# Mapping Missouri's Future
## A Statewide Geographic Information Strategy

Final 7/3/08

Adopted by Timothy L. Haithcoat, Missouri Geographic Information Officer, and the Missouri Geographic Information System Advisory Committee in July 2008.

The **Missouri Geographic Information Systems Advisory Committee (MGISAC)** was created by an executive mandate of Missouri's Chief Information Officer to provide leadership in the development, management and use of geographic information and related technology in the state. With administrative support from the Missouri Spatial Data Information Service (MSDIS) in the University of Missouri (MU), the committee provides policy advice and makes recommendations regarding efficient investments, management practices, institutional arrangements, and data standards and education.

*Mapping Missouri's Future* was prepared by the Committee's Strategic Planning Sub-Committee and approved by the GIO and MGISAC in July 2008.  We would like to acknowledge the use of ideas, constructs, and approaches garnered from the following state reports that preceded our effort:
- Maryland State Geographic information Committee – Building an Effective Statewide Spatial Data Infrastructure - Strategic Plan (2007);
- Minnesota Governor's Council on Geographic Information – A Foundation for Coordinated GIS: Minnesota's Spatial Data Infrastructure - A Strategic Plan (2004); and
- Wisconsin Location Matters: A Statewide Geographic Information Strategy (2007).

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Web availability: *Mapping Missouri's Future* is available on the GIO's web site at www.gis.mo.gov. Upon request, the document will be available in alternative forms. For additional printed copies, contact the Information Technology Services Division at 573-751-1504.

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# 1. Executive Summary

Smart growth. Emergency response. Wireless E911. Pandemic planning. Voter registration. Redistricting. Each of these present serious challenges for our society and the public expects and deserves these and numerous related issues to be addressed efficiently and effectively. The coordinated use of geospatial technologies (geographic information systems (GIS), global positioning systems (GPS), remote sensing, and web mapping services) is the most effective way to meet these challenges. Although many organizations already use some element of GIS to help support individual program planning, management, monitoring, or evaluation, many others lack these resources. Also, for many of those who have implemented geospatial technologies, it exists as project-based or siloed applications whereas the evolution of these technologies is towards operational, service oriented, transparent enterprise applications at the foundation of business processes and organizational mandates.

Missouri needs overarching intergovernmental and interdisciplinary sharing of geographic information, technologies, and services. This document presents a plan for improving the coordination and delivery of geographic information services across Missouri. The plan consists of five broad goals and associated strategic elements. These components, when set in motion, will propel the state forward to build the foundational Missouri Spatial Data Infrastructure (MoSDI) and support the realization of an interoperable information vision.

*Mapping Missouri's Future* was developed as a roadmap to guide Missouri organizations adopt and adapt geospatial technologies within their business operations and mandated activities. This will lead toward more effective government and an enhanced quality of life for all Missourians.

The envisioned Missouri Spatial Data Infrastructure (MoSDI) framework includes policies, standards, and best practices that would improve the availability of needed data, promote integration, encourage collaboration, and extend access. Achieving this vision would dramatically improve the effectiveness of state, local and regional programs ranging from public safety to natural resource management to economic development while also reducing costs associated with these programs. This document describes GIS in Missouri, the aim of this MoSDI foundation, and its importance. It identifies critical shared geospatial data and technology needs and how they are to be addressed. Further, it recommends actionable steps and process requirements to implement a maintainable and sustainable MoSDI.

The MoSDI will address the business needs of Missouri's governments while seeking to leverage and facilitate the ongoing data development by local, regional, state, and national organizations to meet common needs. This strategy emphasizes local stakeholder production of data, and the development of actionable maintenance plans that clearly identify the benefits, thus serving to focus and leverage investments across this infrastructure.

### Strategic Goals of <u>*Mapping Missouri's Future*</u>

**1. Collaboration and Coordination**

Implement mechanisms to improve program coordination and technical collaboration among GIS stakeholders. The most critical component for improved coordination across the state is a dedicated, full-time Geographic Information Officer (GIO). Explicit authority and responsibility for overseeing the development and implementation of the MoSDI should be assigned to the GIO, exist within a state cabinet level agency, and be supported by a budget line, and if necessary, legislation. The GIO will work with the MGISAC, CIO, MSDIS, and appropriate stakeholder organizations to prepare recommendations for such changes. The GIO will serve as the lead advocate for Missouri's geospatial community.

Develop and establish a single "Missouri GIS Portal" to inform and support both the public and the GIS community in the:
- discovery, acquisition, use, and management of geographic data;
- geo-based information, activities, resources, and standards;
- GIS services, tools, and applications; and
- collaborations and partnership opportunities.

Inform and educate existing GIS users in Missouri through a functional resource file system and contact listing – concept of 'GIO's Filing Cabinet.' The Missouri GIS Portal is the single means to access all information related to things geospatial for the state and its creation, relevance, and maintenance is paramount to the successful achievement of the goals outlined in *Mapping Missouri's Future.*

**2. Data Development and Standards**

Build an effective and efficient program to create, document, standardize, integrate, and maintain geographic data in support of Missouri's geographic information needs. Inventory statewide geospatial data assets at all levels to assess their current condition and status and complete Data Development Plans for targeted MoSDI framework data themes. Prioritize critical geographic data gaps and develop plans to build, acquire, or enhance these data. To include appropriate standards, funding mechanisms and approaches, and business case development. GIS implementation by state agencies should be compliant with the guidelines and standards established within the Missouri Adaptive Enterprise Architecture as well as consistent with State policies.

**3. Geospatial Services**

The continued development of the Missouri Spatial Data Information Service (MSDIS) as the state's NSDI Clearinghouse should be supported, emphasizing simple, cost-effective solutions for distributing geospatial data. Focus on improved services for the acquisition, discovery, sharing, and use of geographic information and technology through MSDIS. These services will help reduce redundant activities and will facilitate the delivery of critical information to the public and the broader geospatial community.

At the state level within the Information Technology Services Division (ITSD) move forward with service-oriented architecture (SOA) models for distributed content management and mapping services provision. Implement and support fail-over,

backup, and recovery for Missouri's geospatial assets. Identify and implement metrics that can be tracked to support scaled development as geo-services grow and expand.

## 4. Funding

Establish funding mechanisms sufficient to operate ongoing programs and support new initiatives that address critical business needs. Work with Missouri's Office of Administration to prepare and seek support for organizational change and budget initiatives that address issues identified in *Mapping Missouri's Future.* This would include: Defining roles and responsibilities within the geospatial organizational structure; Establish the level of funding required and funding model appropriate to support the broad development and maintenance of the MoSDI; Establish the level of funding required and define a funding model appropriate for the Missouri GIO office; and Evaluate the current level of funding for MSDIS and what is required to meet the goals of this Strategic Plan and define an appropriate funding model. Lack of adequate and sustainable funding is one of the most significant barriers to the coordinated development, use, and maintenance of geographic information resources and services statewide. Work to change the funding profile for GIS from a 'project-based' view to a 'core infrastructure' view.

## 5. Communication and Outreach

Increase awareness, knowledge, and expertise in the value and uses of geographic information, technology, and services. Expand the Missouri Geographic Information System Advisory Committee (MGISAC); a broadly representative body whose purpose will be to provide a forum for geographic technology leadership in Missouri. Identify champions, groups, and organizations that would be appropriate members and allies in achieving the goals of *Mapping Missouri's Future.* Support and expand the regionalization efforts within the MGISAC, RPCs, Users Groups, and Homeland Security initiatives to create more opportunities for affordable, local technical and technology workshops and training. Conduct outreach to refine and build support for the MoSDI vision, including making presentations at the stakeholder conferences and using the Missouri GIS Portal website to post information and promote feedback. Support initiatives and activities of organizations that address the data needs identified in *Mapping Missouri's Future* and which are consistent with its recommendations regarding organization, responsibilities, and policies.

Missouri's vision is that stakeholders would have "real-time" access to high-quality geographic information, technology, and services for sound and coordinated decision-making. This vision is achievable as examples of many aspects and elements already exist in other states across the nation. Putting it all together and gaining success depends upon the willing collaboration of many entities and individuals. There is no question that the coordinated use of GIS will expand economic development, improve public safety and public health, help protect our cultural and natural resources, and make us better prepared for Missouri's future.

Specific actions are required to begin the successful realization of Missouri's vision:

- Under the guidance of the GIO, and through the activities of the MGISAC and MSDIS, specific tactical implementation plans must be developed for each goal. These implementation plans must include detailed objectives and proposed solutions for achieving each goal. Business plans that outline the costs and benefits for each element undertaken are also required. Further involvement from the legislative, administrative, and broad GIS community and other stakeholder groups and organizations will be necessary in the development of these plans.
- The contents of this plan must be communicated to stakeholders and decision-makers across Missouri. Without their willingness to participate and collaborate, and without their political, technical, and financial support, this plan will fail.
- For each goal and strategy for which tactical elements are developed, metrics and 'scorecards' need to be developed to track and assess progress as well as provide accountability for these efforts.

*Mapping Missouri's Future* was developed with extensive involvement of Missouri's broad GIS community and is endorsed by the Missouri GIO Office and the Missouri Geographic Information System Advisory Committee. It represents a focused starting point from which the continuing development and integration of geospatial technologies and services to the nation, state, and citizen can be launched.

# 2. Introduction

GIS is one of the most pervasive of today's technologies.  Increasingly, our society relies on — and benefits from — information about the location of people, places, things, and events. Principles and practices fundamental to the way our society functions (ownership of land, for example) are based on geographic information. Everyday life is difficult to imagine without maps and locational information to enable vital activities such as land and property administration, transportation and logistics, agriculture, natural resource and wildlife management, environmental management, emergency services, homeland security, and health and human services.

In addition, access to geospatial data has become universally available with Internet tools such as Google Earth and Microsoft Virtual Earth. These tools are used daily by individuals and businesses for navigation and general viewing purposes. The popular media is shining a spotlight on geographic information technology with stories about maps on phones, GPS in cars, and near real-time aerial pictures of news events such as tornados, floods, and military conflicts. Unfortunately, the general public is not always aware of the limitations of the underlying data presented on this variety of Internet mapping sites. Providing education regarding what they see and how to interpret the information will improve the overall ability of government, businesses, and the general citizenry to use these mechanisms in providing services.

**Geographic Information: It's Foundational to Our Future.** Geospatial technology was named by the '*President's High Growth Job Training Initiative'* as one of the 14 industry sectors expected to see exceptional growth in the future. This new industry has a current worldwide market of about $5 billion, and is growing by 10 to 13% per year, a growth rate that is expected to continue throughout this decade. Increasing demand for readily available, consistent, accurate, complete, and current geographic information and the widespread availability and use of advanced technologies is causing rapid expansion and adoption with many sectors being transformed by this technology. This is driven, in part, by the growing awareness caused by consumer mapping/visualization platforms, and even more by the growing awareness and benefits that full GIS provide the organizations.

 We are seeing increased interest in enterprise GIS services and platforms that allow users to extend their applications to colleagues in other departments, other organizations and across the Web using easy-to-use visualization browsers. These systems are moving from the desktop and siloed departmental solutions into systems that interconnect many departments using shared GIS services. The Web, Web services, and service-oriented architecture (SOA) provide a new pattern for implementing GIS systems. Increasingly a web-based platform will be used to serve data, analytic models and maps to other users. The server will also be the platform for supporting integration of GIS knowledge into enterprise systems. As society becomes familiar with visualizing things through mapping portals, there will be increasing interest in services that go beyond simple maps and images. GIS servers managed by public and private GIS organizations will be used to provide these kinds

of complementing services. This Web services platform also allows users to integrate GIS data with mainstream enterprise applications and data stores. This type of spatial enabling of business applications promises to further expand the geospatial solutions.

Successful GIS operations are those that have deliberately and consciously integrated GIS use into the strategic planning of the organization. The key to maximizing benefits of GIS comes from the deployment of an enterprise or organization-wide program. Making geographic information more accessible has many benefits. It is important to remember that greater accessibility necessitates additional coordination and integration. The geographic information officer (GIO) is an important member of management and is responsible for producing information that impacts both decision-making and day-to-day operations.

**Effective and Efficient Government.** Many groups periodically rethink and reengineer their workflows to improve the effectiveness of their processes and to save money by delivering public services more efficiently. Recognizing, understanding, and incorporating the role geography plays in these processes can lead to improvements in the access, delivery, and use of government services. Nearly 90% of all citizen requests to government entities are geographically related. Linking a mapping interface to a government web site leads to a more interactive and informative process. Integrating GIS creates effective communication and collaboration environments. A GIS can integrate and share a range of information across departments in an efficient and understandable fashion that is useful for staff, external stakeholders, business partners, clients, and Missouri citizens. One example is mapping and management of private and public property to provide a basis for equitable and consistent taxation, efficient operations, effective local planning, and recovery of unreported taxable events. Digital parcel maps serve the citizens effectively as well as provide a public service for title companies, realtors, developers, and others needing help identifying and describing parcels. A GIS enables an organization to improve efficiency and do more work with fewer resources while reducing costs and providing better service.

**Planning and Economic Development.** GIS offers enormous potential to support economic development and planning activities. These systems can be used to support analyses related to business expansion as well as the formulation of effective public policies to support this expansion.

Examples of public policy decisions (Drummond, 1995) that GIS can be used to address and develop include:
    * Identify current and emerging clusters of globally competitive industries
    * Determine the best locations for new investments in public infrastructure
    * Develop fair, effective incentive programs to encourage job creation in
        distressed areas
    * Target education and training programs to support vital industries
    * Organize networks of small business for joint marketing and purchasing

A GIS can be used to identify sites, locate customers and suppliers, and minimize transportation and shipping costs. Major retail chains (e.g., McDonalds, Starbucks,

Wal-Mart, and Walgreens) plan new store locations and design marketing strategies based on geographic information. Trucking companies use geographic information to optimize the logistics of freight movement. Utilities use geographic information to build and maintain distribution networks. Road and bridge departments use GIS to manage information about the condition of roadways and to determine the distribution of maintenance dollars.

Economic development is dependent on quality, accurate information from many sources. An interested company or consultant is likely to request information on brownfields, wetlands delineation, water/sewer/electrical infrastructure, utility costs, labor pool availability, and many other pertinent needs. If the proposed developer can access this information quickly, weeks, sometimes months, of delay in siting could be eliminated. With sound Missouri geographic information in-hand, promoting desirable and sustainable development to interested business prospects worldwide (with web-based tools to assess site suitability or provide sophisticated marketing analysis) will roll out the welcome mat to new audiences all over the world.

**Coordinated Emergency Response Improves Public Safety.** Many Missouri communities are subject to natural and man-made disasters. The identification, prioritization, development, use, and maintenance of statewide geospatial information and technology are critical elements of the State Preparedness Report (SPR). These data can be applied to safety planning activities within the areas of hazard and risk assessment and resource deployment analysis and planning. The design and implementation of these data collection and dissemination systems ensures that the information collected, processed, and disseminated will continue to grow in its interoperability. Resources, devices, and technologies must also be aligned to operationally protect citizens and assets. These data management processes can be used to collect and distribute location-based damage assessment information that can assist emergency response situational awareness.

Examples of emergency management decisions that GIS has been used to address and develop in support of flooding events in St. Louis include:
- Plan for and notify of evacuation and transportation routes
- Predict flood impact area
- Predict potential road inundation
- Position response units
- Track assessment operations
- Protect threatened infrastructure (in this case, Ameren substations, all of which were successfully sandbagged)
- Manage damage assessment logistics to avoid redundancy and to speed routing
- Notify public of: Areas of risk; Areas of hazards; Road closures; Shelters; and Power outages
- Historical mapping to document past disaster experiences (e.g. flood extents) and associated structural damage (e.g. which properties will need inspected)

The mapping and locational asset data is being integrated within the Missouri Emergency Resource Information System (MERIS). This MERIS has been adopted, and actively promoted to Regional Homeland Security Oversight Councils (RHSOC),

Regional Planning Councils (RPC), counties, and municipalities. The implementation of this system will improve the overall impact of Missouri's emergency response system and lead towards more actionable responses, risk mitigations, and proactive recovery plans. This implementation fosters more effective access to geospatial information maintained statewide by governmental entities and complements federal homeland security and geospatial programs of the DHS, NGA and USGS. Above all, this mapping will help Missouri be proactive to our emergencies instead of reactive.

**Standards.** Broad use of standardized information reduces the potential for unnecessary costs by preventing duplication of resources and efforts. We cannot afford the inefficiency and cost of incompatible, conflicting, and/or duplicated geographic information resources. Furthermore, these costs are not purely monetary: Inaccurate address information can lead to delayed response to emergencies, which can have a number of obvious negative consequences. And inadequate data-sharing mechanisms can lead to ineffective resource management practices by environmental management, agriculture, and planning agencies.

## Missouri's Vision:

The MoSDI parallels the National Spatial Data Infrastructure (NSDI), a nation-wide strategy established in 1994. It is adapted to focus upon Missouri's business needs and priorities. The NSDI calls for technologies and policies that support sharing of geospatial data among all levels of government, the private and non-profit sectors, and the academic community. It provides a base or structure of practices and relationships among data producers and users that facilitates data sharing and use. The intended result is to reduce the costs of developing geospatial data while maximizing its value through widespread availability and use. The NSDI vision is fully compatible with Missouri's vision, embodied in the following strategic guiding principles of the MGISAC:

- Foster cooperation among state, local, and federal agencies, educational institutions, private industry, and others in the field of Geographic Information Systems (GIS);
- Provide guidance for the Missouri Spatial Data Information Service (MSDIS) in fulfilling the distribution objectives of the Missouri GIS Advisory Committee's Strategic Plan;
- Develop GIS standards for the state;
- Provide a forum for interaction among GIS stakeholders to foster discussions of relevant GIS issues;
- Provide expert advice to the Chief Information Officer (CIO) and the GIS community on GIS related issues;
- Facilitate discussion and resolution of GIS issues impacting the state;
- Coordinate and facilitate statewide training as needed; and
- Work together with other states on standards and other GIS issues.

The MoSDI, like the NSDI, focuses upon standards, policies, procedures, and relationships that support the development, management, maintenance and distribution of commonly used data and content. In Missouri, 10 framework data classes have been selected as essential for the MoSDI. Included within the MoSDI

framework data layers are NSDI framework data. Taken together, these framework data elements provide for a common base for mapping other features – for example, parks, residences, hospitals, power plants, or bus routes – data needed to support the efficient and effective delivery of services to Missourians. Others, such as land cover may be added in the future. The seven data layers that serve as a common basis for most GIS applications is illustrated by Figure 1.
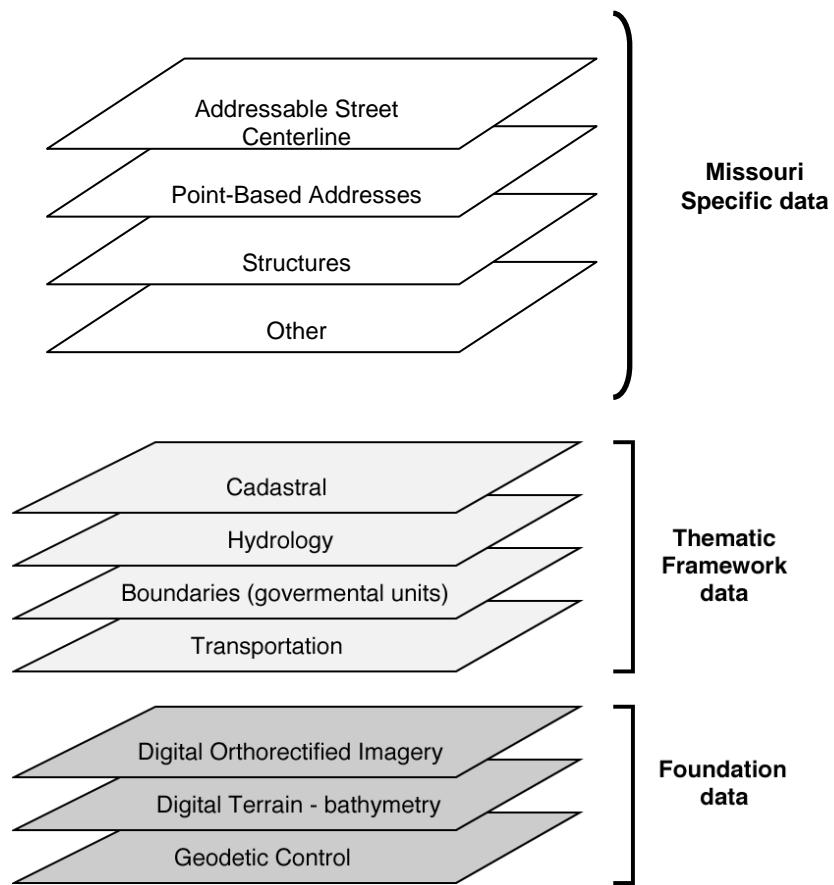


Figure 1:  Missouri Spatial Data Infrastructure (MoSDI) Target Layers

The effective and efficient use of geospatial data to deliver services also requires that the data is available when needed, wherever needed. Too often, geospatial data that can benefit the public goes unused because effective distribution policies or mechanisms are not in place. At times, cost or licensing restrictions have limited data use.

While restricted access to geospatial data may be appropriate in some instances – privacy or public safety are two notable cases – the public benefit will be greatest when geospatial data becomes available through a well integrated data distribution infrastructure, supported by clear policies and well-defined organizational relationships. Like the data itself, such technology, policy and organizational issues

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are essential components of the MoSDI.

This document outlines strategic elements to be incorporated into plans for data development, management and distribution. Teams of professionals that depend upon each of the framework data themes in their work will be assembled to draft these plans. In these reports, these Teams will provide an overview of each theme, its importance, its description, current status, funding elements, data and distribution issues, stewardship, and an implementation strategy with short, mid, and long-term recommendations (See Appendix C for template – adapted from Minnesota model).

## 2.1. What is GIS?

A geographic information system (GIS) integrates personnel, hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared. The key word to this technology is Geography - this usually means that the data (or at least some proportion of the data) is spatial, in other words, data that is in some way referenced to locations on the earth. Coupled with this data is usually data known as attribute data. Attribute data is generally defined as additional information that can then be tied to spatial data. An example of this would be schools. The actual location of the school is the spatial data. Additional data such as the school name, level of education taught, school capacity would make up the attribute data. It is the partnership of these two data types that enables GIS to be such an effective problem-solving tool.

GIS operates on many levels. On the most basic level, GIS is used as computer cartography, i.e. mapping. The real power in GIS is through using spatial and statistical methods to analyze attribute and geographic information. The end result of the analysis can be derivative information, interpolated information or prioritized information. More than 80% of all data collected has a geographic—or location— component (such as address, zip code, census tract). GIS is used to analyze demographic trends and patterns; manage assets such as utilities, infrastructure, and resources; form a basis for planning, operations, and decision-making; manage map service locations; and plan and deploy local and statewide response to emergencies and other crises. Geographic data and tools comprise a valuable resource that is becoming widely recognized as a critical asset. Geographic data and GIS technology are vital to responding successfully to many of Missouri's biggest challenges.

## 2.2. History of GIS development in Missouri
The University of Missouri (UM) in Columbia began using this technology in 1980 when the Geographic Resources Center (GRC) was created. Missouri's geographic information and related technology (GI/GIT) activities across state government were initiated in 1988 as the Missouri Department of Natural Resources (MDNR), Missouri Department of Conservation (MDC), and the Highway and Transportation

Department started developing department-wide GIS approaches at this time.

As these and other agencies became more active with GIS, an informal Interagency GIS Cooperative was created in December 1989 among interested state and federal agency representatives. Governor Ashcroft recognized the need for GIS coordination at a statewide level at this time. He designated MDNR to serve as the lead agency for GIS in state government. As a result, MDNR's representative in the Cooperative, GIS Administrator John Finley, served as the Cooperative's chair until the end of 1990 when that position at MDNR was vacated. Several efforts were made in 1990 to increase the awareness of agency directors about GIS potential, including a meeting of agency directors, which served to heighten interest and support, but no leader came forth to carry this agenda forward.

The University of Missouri (UM) in Columbia and its Geographic Resources Center then became more involved in coordinating statewide GIT. In January 1991 Tim Haithcoat of the GRC drafted a letter, which in essence reorganized this group with the purpose of identifying GIS users, their databases, and transfer procedures, as well as to provide a forum for these users within Missouri. The group was renamed MOSAIC (Missouri Systems Access & Information Consortium). This group opened the forum and activities to both public and private users. Several meetings later this group put forward the idea that to achieve the purposes and goals of data sharing and coordination, a more formal structure or entity was needed as well as a business plan for its implementation.

Attention began to grow about information technology and GIT in the mid-1990s. Tim Haithcoat (GRC) drafted a "Strategic management plan for the management and coordination of Geographic Information System (GIS) technology and the creation of a State Spatial Data Center" in July 1993, which presented and advocated a statewide approach. This was then reviewed by several state and federal agencies. After revision this proposal then went forward to the Governor's Office where it was well received. It was then forwarded as a general revenue budget item into the Missouri State Budget. However, in the final moments of a House budget hearing the source of the funds to implement this plan were altered. Due to limitations of the funding source the actual implementation could not occur during FY93. A different tact was taken in FY94 whereby the Missouri Department of Conservation committed $30,000 and the Missouri Highway and Transportation Department committed $25,000 to the GRC to organize the implementation of the strategic plan and its funding base within state government. In the FY95 Missouri Budget Bill the Governor then proposed and the Legislature authorized and funded $158,000 to direct the GRC to "*develop a clearinghouse for information on use of GIS systems and on those public data bases available . . to improve the quality and efficiency of state governmental services and decision making through wider application of improved Geographic Information.*" Funding was organized through a line item within the University of Missouri - Columbia's FY95 budget, specifically ear-marked for the creation of a State Spatial Data Center within the GRC. The GRC created the Missouri Spatial Data Information Service (MSDIS), and has provided related GI/GIT services for the state since then. Governor Carnahan then sent a letter to directors of state agencies on March 22, 1995 inviting them to "join in launching the Missouri GIS Initiative." The focus of discussion at the April meeting was the strategic plan

submitted by Tim Haithcoat of the GRC. A more formal organization arose from that meeting and those that followed. From these meetings, the core and foundation of the existing Missouri GIS initiative was refined and re-formed. Also during FY95 the start of the federal-state cooperative agreement for acquisition of statewide ortho-photography was initiated in the state.  This agreement created a focus for collaboration and cooperation among state and federal agencies.

In 1995 a new Office of Information Technology (OIT) and Information Technology Planning Board (ITPB) were established. These developments provided a home for the GI/GIT activities taking place within the state. Statewide GI/GIT coordination activities continued in 1996. The new CIO, Mike Benzen was approached to garner his support for this group. Tim Haithcoat prepared a new "Strategic Management Plan for GIS Technology and the Maintenance of MSDIS" that was submitted in March 1996 in coordination with OIT. Following review of this plan, a formal Missouri GIS Advisory Committee (MGISAC) was organized later that year. While not established by Gubernatorial or Legislative actions, the group was established as a standing committee under the then Office of Information Technology. The Advisory Committee was established to report to the Chief Information Office, as well as make an annual report to the Information Technology Planning Board. The MSDIS budget item continues as part of the base budget for the University of Missouri.  As will be seen below, GIS and its associated technologies has continued to grow and expand both within State government as well as across our local government sector.

### 2.3. Current status of GIS in Missouri

The use of GIS is advancing at all levels of Missouri government. Virtually all agencies collect data that has a geographic aspect, and nearly every one of Missouri's Cabinet Level Departments uses GIS technology in some capacity. Forums such as the MGISAC and the State Agency GIS meetings provide coordination across some organizations. Activities within several agencies are further coordinated by GIS staff.  However, unlike other common business functions across state government, such as information technology and procurement, geospatial activities have not been formally coordinated until recently.  As a result, many past opportunities for cross-agency collaboration, development, communication, and interoperability have been lost.

In many cases, local government collects the most detailed, up-to-date geographic data, including new information about roads, properties, buildings, water features, and other aspects of the local landscape. State agencies can realize tremendous benefits from using local data to achieve their mission at the state level, but the absence or awareness of formal state standards within local government have made integration difficult.  Complicated data sharing agreements and cost recovery models further stifle this opportunity. Active coordination with local governments and their affiliated Associations is being actively pursued by the State. The current imagery buy-up options for local government being an example of this activity. These partnerships and collaborations are growing and provide a bright future for GIS in Missouri.

### Coordination

Coordination has occurred through the newly designated Geographic Information

Officer (GIO), as well as the Missouri GIS Advisory Committee (MGISAC) and the Missouri Spatial Data Information Service (MSDIS).

**Missouri Geographic Information Officer (GIO):** (http://www.gis.mo.gov) The roles and responsibilities of the GIO in Missouri include directing and coordinating inter- and intra-agency, as well as intergovernmental, GIT functions. The GIO serves as the State representative on spatial technology matters, assisting with the use of spatial technology in order to improve governmental and agency services and operations.  Duties include seeking funding coalitions and opportunities for GIT development, facilitating the sharing of spatial data and ensuring integration of geographic information technologies into agency-wide information systems. Additional duties include serving as a representative to appropriate geographic information systems and technology committees and user groups as well as planning and coordinating GIT projects and performing administrative fiscal functions. The GIO must also be the point of contact for data sources and advising on data acquisition, and coordinating and facilitating activities among GIT staff within various governmental units.  When fully staffed, the GIO will have supervision of assigned staff and provide general oversight and coordination to other GIT staff, MGISAC, and MSDIS.  Administrative direction is received from the CIO office; however, the GIO is expected to exercise considerable initiative and independent judgment in directing or assisting in the direction of the State's activities with regards to GIT integration.

Missouri has not been able to support a full-time dedicated GIO position. The current GIO, Timothy Haithcoat, is working full-time as the GIO only two days per week. Previous GIOs (Ryan Lanclos – formerly with MO Dept of Agriculture and Tony Spicci – MO Dept of Conservation) held this position as additional duties to their full-time appointments in their agencies.  Both of these individuals found that model to be problematic. It is the desire of the State to make the GIO a full-time, permanent position with associated budget.

**MGISAC** (http://www.mgisac.org) serves as the Committee for statewide GI/GIT coordination. It is supported by additional regional coordination and users groups in the state. The committee was officially established in 1996. The MGISAC's first chair was Ryan Burson, the State Demographer, located in the Division of Budget and Planning of the Office of Administration. The MGISAC operates under and reports to the CIO within the Information Technology Services Division (ITSD). It has no dedicated budget for its activities. The committee currently has 23 members, with representatives from state agencies as well as other sectors including academia, and local and federal government. Monthly meetings include a review of administrative elements (by-laws, nominations, treasurer report), GIO report, and possibly a presentation. Subcommittees are functioning and provide updates and reports for the following areas:
- Data development
- Funding and grants
- Homeland security
- Local government
- Outreach and education

- Strategic planning

The Committee has Liaison Reports from areas such as GIT Architecture (MAEA), Policy and Legislation, MSDIS, Missouri GIS Conference, and the MAGIC Consortium. As well, Cooperating Agency / Organization Reports are provided by representatives from NRCS, USGS, Missouri Association of Councils of Government, Missouri Resource Assessment Partnership, Missouri Mappers Association, Missouri Society of Professional Surveyors, and the National States Geographic Information Council.

The MGISAC also hosts an annual GIS conference. This conference is held as a stand-alone conference in odd years and in conjunction with the Mid-America GIS Consortium Symposium (MAGIC) in even years. The GIO (Tim Haithcoat) and the Program Director of MSDIS (Mark Duewell) are ex-officio members of the Committee. The current chair is Steve Marsh, CIO for Jackson County Missouri.

**MSDIS** (http://msdisweb.missouri.edu) The Missouri Spatial Data Information Service (MSDIS) was established at the University of Missouri's Geographic Resources Center in 1995 following initial funding provided by the Legislature. This established a clearinghouse and thus provided services to state agencies and others in this regard. MSDIS has continued to operate on state funds provided through the University of Missouri's appropriations. These funds are supplemented by project-based funds from state and federal sources. Data have been collected from local, regional, state, federal and other sources to serve in this role, including satellite data. MSDIS staff have maintained an active role in this regard and beyond in reporting to and providing assistance to the MGISAC and the State.

MSDIS has the following goals:
- To allocate MSDIS resources where they will most benefit the Missouri GIS community.
- To establish and make available to the GIS community in state government and beyond a core data base of geographic information to be held and maintained in common as a continuing asset within an archive.
- To encourage development, maintenance, and dissemination of thematic databases built on the core data base foundation.
- To advise and assist the Office of Information Technology in setting GIS standards in Missouri.
- To encourage use of GIS technology and geographic data resources in state government by providing practical support to users
- To inform and educate supervisors, managers and other professionals in the state about GIS technology, its current capabilities and future potential.

MSDIS provides geographic data access and distribution services for the state. The MSDIS is a registered NSDI Clearinghouse node and is searchable via those mechanisms. It is regularly harvested by the Geospatial One Stop (GOS) to populate the federal geospatial registers. The MSDIS has dedicated staff to serve in this role.

## 2.4 Benefits of Missouri's Geospatial Strategy

Missouri's vision is that the Missouri Spatial Data Infrastructure (MoSDI) will support the development and use of geospatially-enabled applications that enhance the efficiency, effectiveness, and economic competitiveness of both public and private organizations serving the people of Missouri. The impact of improving geospatial coordination will be broad-reaching and include tangible benefits, such as saving money and saving lives, as well as intangible benefits, such as improving citizen engagement, protecting natural resources, and improving agency workflows and efficiencies. There are also many interwoven benefits to producing and using Missouri framework data and being participatory in this framework's development. Specifically, coordinated, collaborative implementation enables Missourians to receive the following benefits.

• **Benefit of leadership and collaboration.** The MoSDI will provide a policy and organizational framework that promotes effective collaboration among public and private organizations that use geospatial technologies to support their business activities. The active development of partnerships and resource / data sharing agreements will enable us to leverage and encourage joint projects and funding, sharing of systems and data, and adoption of uniform practices based on sound standards.  These partners can resolve problems created by conflicting data and redirect their resources associated with duplicate data production and maintenance to more primary business activities.  Achieving these aspects will expand funding opportunities through recognition and credibility as a framework participant.

• **Benefit in fiscal stewardship.**
Implementing the MoSDI will result in productivity gains by greatly reducing labor and cost in accessing information, integrating multiple data sources, performing complex analyses, and presenting information in map form. As well, cost avoidance can be realized through more effective management of infrastructure, lowering damage from natural disasters through better planning, and protecting organizations from costly legal or regulatory challenges by providing largely unbiased critical information.

• **Benefit in user services.** Geospatial technology users will have timely access to the data they need, appropriately formatted to support business applications ranging from public safety to environmental protection.  Implementing this plan will provide staff and management with the information needed to respond quickly to problems or concerns, offer quality service, and consider all pertinent issues and impacts. It will serve to improve customer satisfaction through better information, faster response, improved operations, and informed decision making as well as attract clients who need data that are registered to the framework.

• **Benefit in producer development.** Data producers will expand the availability of their geospatial data while reducing their distribution costs by sharing distribution mechanisms that complement and add value to their own business solutions. It will also save development effort by using framework data standards and standardized data, guidelines, and tools. Use of common formats and access methods allows producers to utilize data produced by others more quickly and reduce the load from data requests by providing direct access to their data through the framework. Finally

producers can save money by sharing the costs of data production and reducing duplicative efforts.

• **Benefit in application and tool development.** The MoSDI will include a shared technology infrastructure that provide cost-effective and responsive technology solutions for data management, data distribution, and specialized applications that compliment and add value to solutions that organizations implement to meet their own needs. This will allow clients to develop applications faster and more easily by using existing data, data development standards, and web services and geospatial tools. These tools, utilized across interoperable systems and databases, can then perform analyses, support decision making, and permit operations in cross-jurisdictional areas.

Taken together, the MoSDI will result in strategic guidance of investments in geospatial data and technology, complementing and leveraging federal investments that support the National Spatial Data Infrastructure and supporting faster, better, and financially responsible services for the people of Missouri.

# 3. Strategic Plan for MoSDI

## 3.1. Missouri's Strategic Planning Process

Recognizing, understanding, and prioritizing current business drivers and emerging issues is critical for successful GIS strategic planning. Missouri's plan is responsive to the needs of the state's residents, businesses, and decision-makers, who expect excellent client service and easily accessible and understandable information. They also expect more work to be accomplished with fewer resources.

The two primary objectives for this project included: 1) development of strategic and business plans; and 2) outreach and education to promote the plan and distribute a local 'How To' guide for geospatial development. While the general ideas inherent within these objectives remain, the activities to achieve those objectives have changed from the original project agenda. Those changes were primarily a reflection of a change in the grant principle investigator, Missouri's GIO, Tim Haithcoat. As well, the Strategic Planning Subcommittee of the MGISAC worked hard to achieve this expanded scope. The strategy reflects a 'stakeholder-first' approach. Eight regional meetings (rather than 3 central state meetings), scheduled across the state, were used to inform creation of the strategic and business plans.

*Regional Meeting Schedule & Hosting Organization*
> January 10, 2008 – Jefferson City – Central Missouri - MGISAC
> January 16, 2008 – Springfield – SW Missouri – SE GIS Users Group
> January 22, 2008 – Kirksville – NE Missouri – Adair GIS Consortium
> February 19, 2008 – Cape Girardeau – SE Missouri – Southeast RPC
> February 27, 2008 – Kansas City – Mid-America RPC
> March 11, 2008 – St. Louis – East-West Gateway RPC
> March 19, 2008 – Maryville – NW Missouri – Northwest RPC
> April 10, 2008 – Jefferson City – Central Missouri - MGISAC

All 8 regional meetings were very successful. Here are some of the successes from these regional meetings.
- The regional meetings have been constructive listening and feedback sessions to get a clear understanding of local government obstacles and needs.
- All of the meetings concluded with conversations about how to continue organizing and reinforcing needs and opportunities.
- We have begun a conversation between these regions in the state by showing the results of pre-regional meeting survey results. These surveys show priorities and opinions in the regions for database development, funding, resource needs, and administrative support.
- We continue to build a database of local contacts and champions for future reference and collaboration.

The information and working relationships built during this process were, and will continue to be, a rich contribution to our strategic and business plans, and most importantly an on-going measure of success and feedback. These meetings also

served the stakeholder groups as they learned about services, resources, and opportunities available for them to start or improve their GIS program.

The sum of our successes is a product of the number and range of people who participate in this process.  Participants included federal, state, county, municipal, university, emergency management, planning, surveying, mapping, GIS, students, and other representatives. A total of 133 people participated in the regional meetings. Interestingly, most of the participants were not MGISAC members but professionals from other groups who recognized the need to better leverage geographic information and technology for their own needs. The participants compiled ideas and data about GIS changes and trends, current strengths and challenges, and critical success factors.

We had 91 people fill out a 10-question Strategic Planning survey (Appendix A) for use in the Strategic Planning process. Both 'regular supporters' and new contributors have engaged in this process with time, resources, lively discussion, and passion. We were fortunate to have a relatively good structure in place (largely due to MSDIS) for this coordination and implementation, but in order to move forward we needed to develop relationships with a still broader range of practitioners. This grant has given us the opportunity to begin and engage that conversation successfully.

The planning horizon developed for this activity is 3 years with an annual evaluation or assessment of progress against the goals.  The plan should be revisited after the completion of the second year and development of new goals and objectives determined during the third year of this plan so that the new plan can be adopted with little to no break momentum.

## 3.2   Measures of Effectiveness

The specific goals of this strategic plan are outlined below in sections 3.3 through 3.8.  These goals, and their related tactical development and implementation, become categories within which measurement indicators, or metrics, must be identified. These measures should reflect a sense of prioritized achievement and should reflect both outcomes and outputs. Specific criteria for individual measurement indicators within each category require that the indicator be informative, feasible to capture, manageable, actionable, and complete.  Generic geospatial performance measurement indicators have been identified and grouped according to a general measurement area and are further described below.

**Mission and Business Results**: The approach is to quantify the effort expended on a program (inputs), the level of services provided (outputs), the effect a service has on the program's stated objectives (outcomes) and a comparison of the level of inputs with outputs or outcomes (efficiency).
- *Citizens and citizen services*: Number of public web mapping services available; number of new users; number of repeat users; feedback mechanisms in place; percentage improvement / growth in web mapping of service;

- *Institutional effectiveness*: Percentage of data accessible to other organizations; percentage of relevant IT strategies leveraging the geospatial aspects of business data; percentage growth in use by non-GIS specialists;

- *Public participation and accountability*: Percentage of public information accessible online; percent of citizen transactions conducted via the internet;

- *Supports improved decision making*: Percentage of internal missions and goals identified and documented; responds to state decision making quickly and correctly; level of integration of geospatial within agency strategic plans; number of activities leveraging geospatial aspects of their business data;

- *Supports MoSDI*: Complies with national standards; status of stewardship responsibilities; number of linkages and status of posting data to the National Map

**Customer Results**: This includes such areas as customer benefit, service coverage, timeliness and responsiveness, service quality, and service accessibility.

- *Ease of use measures*: Decrease in the level of expertise required to support data transmission; decrease in the level of effort required for the integration process; decrease in complexity of the geospatial data; stability of the format definitions; number of new customers; market penetration measures; number of complaints; retention of customers; percentage of customers satisfied with aspects such as application design, maintenance, and support;

- *Broad data-sharing capabilities*: Decrease in the level of effort required to support data transmission; number of inquiries for metadata; number of clientele; diversity of clientele; number of published web services; number of data sharing agreements in place;

- *Data availability and accessibility*: Percentage of data available in timely manner; number of hits per unit time; number of downloads per unit time; percentage of geospatial data holdings available on intranet; percentage of geospatial data holdings available on internet; volume of data sets downloaded;

**Processes and Activities**: This includes the assessment of financial, productivity and efficiency, cycle time and timeliness, quality, security and privacy, and innovation.

- *Coordination and Streamlining*: Number of end users; diversity of end users; number of catalogs registered; number of catalogs on which your service is registered; diversity of catalogs; number of intra-agency partnership agreements and MOUs in place; number of MOUs/SLAs/MOA with external groups; level of participation and coordination with other intergovernmental groups and associations;

- *Business Process Support:* Degree to which geospatial solution supports process improvement plans; degree to which geospatial aids process analysis; degree to which the geospatial solution can adapt to new requirements; percentage of cost to transfer geospatial application to new hardware or software platforms;

- *Efficient use of taxpayer resources*: Tracking number of requests for data and information; Redundant data and application assessments; alignment with other organizations for performance of similar tasks;

- *Minimal barriers to obtaining data*: Number of steps to locate data; number of steps to access data; number of steps to extract data; timeliness of data; accuracy of data; quality of data; geospatial interoperability standards employed; cost of data;

- *Interagency Collaboration*: Number of formal agreements in place; communities of practice exist to promote sharing of data and resources; number of departments participating in the dissemination of data; diversity of departments participating in dissemination of data;

- *Intergovernmental collaboration*: Number of formal agreements in place; communities of practice exist to promote sharing of data and resources; number of organizations participating in the dissemination of data; diversity of organizations participating in dissemination of data; level of participation among agencies;

**Technology**: This includes measures of financial infrastructure support, quality and efficiency of the solutions, information and data access, reliability and availability, and overall effectiveness.

- *Reuse, adaptation, and consolidation*: Policies in place to measure and assess initiatives for duplication; data collected meets multiple business requirements; applications developed meet multiple business objectives; percentage reusability of core geospatial components and services; percentage of total IT costs by major asset categories; percentage of databases that can be shared; number of published web services;

- *IT performance*: Number of hits per unit time; response time for query; response time for transaction; GIS software version control; utilization of geospatial interoperability standards; reliability measures for network; reliability measures for application; reliability measures for hardware;

- *Standards adoption*: Percentage compliance to approved geospatial standardization; documentation of standards employed; percent of staff trained / exposed to geospatial standards; percentage of data development where geospatial standards are adhered to; number of geospatial compliance components adopted; percentage of hardware / software with geospatial interoperability capabilities; percentage of procurement exceptions to geospatial architecture standards; percentage of data with identified steward; percentage of data with formal stewardship agreement;

- *Supports MoSDI*: Contributions to framework data; consolidates or aggregates framework data; adheres to national policies in construction/development of framework data; connectedness to clearinghouse; connectedness to spatial search catalogs; percent of harvestable metadata; number of data sets; number of metadata records; percentage of geospatial data records updated;

- *Purchasing of geospatial components*: total cost of geospatial software components; total cost of geospatial hardware components; licensing costs; data costs; access costs; storage costs;

The degree of commonality or standardization across our collective use of these measures will depend upon whether the geospatial initiative is being managed by a single organization or multiple organizations. A broad organizational assessment / evaluation tool regarding the status of the integration of geospatial technologies within the organization is the Geospatial Integration Maturity Model (GIMM) that is further described in Appendix B.  The GIMM tool and its measures would be a good addition to these measures when assessing performance of this plan.

The following sections outline five strategic goals that if implemented, will move the understanding, use, effectiveness, and value of GIS to a higher level within Missouri. To be accomplished, these goals will certainly require additional discussion, understanding, support, and increased funding.

## 3.3. Goal 1: Collaboration and Coordination

The most critical element necessary for achieving Missouri's GIS strategic goals is effective coordination. Successful coordination implies broad-based communication and a deep understanding of the responsibilities and needs of organizations that develop, provide and use GIS services across Missouri.
GIS coordination must have executive level support and be led by a coalition of entities that serve to facilitate coordination and collaboration among the various stakeholder groups. With all levels of government facing greater demands with reduced funding, inter- and intra-governmental coordination as well as public- private coordination is critical to the effective operation of counties, municipalities, and the state. Some past coordination efforts addressed specific program needs with narrow focus. As Missouri GIS evolves, coordination must become more effective with a broader scope. This will only be achieved through trusted relationships and strong strategic partnerships among the GIS community.

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### *Collaboration and Coordination Trends*

- Expand established statewide GIS coordination councils to ensure that public and private GIS investments, use, and sharing are identified, prioritized, and coordinated among all interested organizations.
- The *National States Geographic Information Council (NSGIC)* and the *Federal Geographic Data Committee (FGDC)* both recognize and promote the value of statewide coordination and the role of state councils.
- Federal funding eligibility for GIS data development is becoming increasingly dependent on the demonstration of effective statewide coordination mechanisms involving a range of public and private sectors.
- Collaboration is not a one-way service, but a two-way exchange.
- There is a recognized effect on data sharing due to perceived data accuracy.
- The identification of champions within the broader stakeholder community is critical to building bridges, forming consortia, and building momentum to effect positive change.
- Interpretation of Missouri's Sunshine Law with respect to digital geospatial data and information may impact the types and extents of data sharing and collaborations that can be achieved.
- There is a growing focus on developing incentives and the identification of benefits across all sectors.

> ### *Collaboration and Coordination Goal*
>
> **Implement mechanisms to achieve the broadest range of geospatial coordination and improve technical collaboration among GIS users, developers, and other stakeholders.**

## *Collaboration and Coordination Strategies*

- Establish a single "Missouri GIS Portal" to inform and support both the public and the GIS community in the discovery, acquisition, use, and management of geographic data, information, and GIS services. It can also be used for customers to order existing or customized GIS products, such as maps, reports, geographic data, publications, and other products.
- Work to establish via Executive Order or legislatively, a dedicated Missouri Geographic Information Officer position (with funding and budget line) within Missouri State government to serve as the lead point of contact for geospatial coordination for the state.
- Development of a list of geospatial champions and stakeholder groups for pro-active development of strategic alliances and partnerships to move forward on the critical issues, priorities, and programs important to the development and implementation of these strategic goals.
- Work to develop guidance and templates for data sharing and liability statements through more authoritative legal opinions with regard to Missouri's Sunshine Law and cost recovery elements.
- Expand the Missouri Geographic Information System Advisory Committee (MGISAC); a broadly representative body whose purpose will be to provide a forum for geographic technology leadership in Missouri.
- Continue to develop, expand, and formalize relationships with regional planning councils, universities, state associations, regional homeland security oversight committees, users groups, and other entities.
- Develop an organizational chart for the state's geospatial leadership components with defined roles and responsibilities.
- Development or implementation of a tool whereby opportunities for collaboration, partnership, or coordination can be discovered and leveraged to decrease duplication.
- Development of a geospatial contact listing for all entities within the state utilizing or developing data as well as any existing data portals or services.
- Development of data stewards at the state and local level.
- Coordinate GIS and associated technology vendor product licensing, contracts, consulting services, purchasing, etc.
- Standardize processes and templates for GIS related RFPs, MOUs, and contracts.
- Support GIS strategic planning, funding coordination, and project collaboration.
- Establish stakeholder groups to resolve issues associated with GIS services. This may include review of state projects greater than $200,000 to evaluate geospatial aspects, opportunities, and possible duplication of overlap.
- Initiate discussions with surrounding states for interchange and integration of information along our borders.

## *Collaboration and Coordination Benefits*

- GIS benefits are increased by data sharing among organizations. For many organizations, building and using a GIS requires enormous amounts of current

and accurate digital data. They can save significant time, money, and effort when they share the burden of data collection and maintenance.

- The costs of data conversion are often so great that single organizations cannot afford to conduct such work. Sharing these costs enables them to implement GIS data and applications that would be impossible on their own.
- Improved coordination will build a useful statewide information infrastructure (MoSDI), e.g., a statewide transportation network, point-based addresses for voter registration, wireless E-911 response, and regional emergency response coordination.
- MGISAC will provide a forum to stay current with expectations, needs, innovation, and technological growth.
- Base map conversion can cost millions of dollars, but when these data are gathered via partnerships, an organization's individual costs are reduced to only a portion of the total. The more partners there are, the more the savings and the greater the efficiency.
- Sharing data can also improve data quality by increasing the number of individuals who find and correct errors.
- Savings realized on the production of common data can be used for other vital areas, such as application development. In addition, resources that would be used to collect repetitive data can be diverted into quality control, data management, and collection of other needed data.
- Working together in a geographic area can also provide data coverage in a common form over a wider area. This aids cross-jurisdictional or cross-organizational analysis and decision making, as well as some types of operations.
- Sharing geographic data that you have created also enables you to defray some of the costs of producing and maintaining those data. For example, if you have collected and are maintaining street data that is needed by other organizations, they may help you fund the ongoing data maintenance.
- MGISAC improves the state's eligibility for acquiring federal funding.

## 3.4. Goal 2: Data Development and Standards

The Missouri Spatial Data Infrastructure (MoSDI), viewed in its broadest sense, is comprised of data, technology infrastructure, policies, and organizational relationships. The recommendations contained within *Mapping Missouri's Future* address policies and organization issues that will result in a robust and sustainable MoSDI. Many of its components are already in place, resulting from several decades of voluntary cooperation by Missouri organizations and individuals that have invested in geospatial data and technologies. These components include:

- **A collaborative culture.** Many Missouri organizations actively collaborate to meet common data and technology needs. Missouri is widely recognized for collaborative investments to produce statewide data and technology, much of it documented at the Missouri Spatial Data Information Service.
- **A supportive institutional framework.** State organizations (the MGISAC and the MSDIS), regional organizations (RPCs and RHSOCs), and professional associations (MMA, MSPS, and others) provide institutional support for achieving the goals of the MoSDI.
- **Shared technology services.** Missouri organizations are developing the shared technology services that will support the broader distribution of geospatial data. MSDIS is the FGDC NSDI Clearinghouse Node for Missouri and metadata repository that allow users to find and download data using the Internet.
- **A commitment to standards.** Missouri has embraced standards that promote collaboration and interoperability. These include standards endorsed by the Missouri Adaptive Enterprise Architecture and adopted as Missouri state standards, guidelines, and best practices. Missouri also has embraced the emerging standards being developed by the FGDC as well as the Open Geospatial Consortium (OGC) and other national and international standards groups.

*Mapping Missouri's Future* pays special attention to data: the seven framework themes of the National Spatial Data Infrastructure as well as other data layers with special importance for Missouri. These layers include:
1. Orthoimagery
2. Cadastral
3. Addressable Street Centerline
4. Transportation
5. Point-based Addresses
6. Elevation (LIDAR focus)
7. Governmental Units
8. Geodetic Control
9. Water Resources
10. Structures

As these themes are prioritized for work, stakeholders from government agencies, professional associations, educational institutions, nonprofit organizations, and business are to be assembled to identify data needs and develop a plan to meet the needs of these stakeholder groups.

Draft Plans following the outline shown in Appendix B are currently targeted for the following themes: imagery, parcels (cadastral), geodetic control, elevation, and hydrography. Progress made on preparing and implementing all Data Development Plans will be carefully monitored and summarized as a "scorecard" that will be posted on the focal portal site for Missouri GIS.

Missouri needs a comprehensive and widely adopted framework of policies, standards, agreements, and best practices to streamline the development of geographic data among stakeholder groups. Missouri has identified and developed several required foundational data sets. However, to support existing business needs and emerging business needs (such as emergency management), some of this data must be enhanced and new data created with more detail and/or attributes.

A consistent framework for data collection, management, integration, and documentation will save time and money. Without this framework, geographic data sharing and integration is often unnecessarily complicated and inefficient. Simply discovering if data exists and how it may be accessed can be exhausting. And when geographic data does exist, it may be in a format or system that cannot be easily accessed, integrated, or used. In addition, the Internet often gives the inaccurate impression that all critical geographic data is already available and accessible. Confusion about data restrictions also hinders sharing, especially during emergencies, when quick access to accurate data is critical.

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## *Data Development and Standards Trends*
- Development of international, federal, and industry standards for geographic data, data exchange, and location-based services promotes efficient data integration and sharing among stakeholder groups.
- It is widely recognized that standards must precede data development.
- Legacy issues continue to be a hurdle to overcome for geospatial data standards adoption, particularly in our larger urbanized areas where GIS was first implemented.
- Metadata development at local and regional levels continues to be sporadic.
- The discovery of incentives and compliance elements for data development to a posted standard is still in its infancy.
- Development of data warehouses with "views" that integrate data from different sources allows data to be collected once and then used for a variety of purposes across programs.
- There are many opportunities to bundle standards-based data development with operational grant programs of state and federal agencies to achieve compliance.
- The ability to assess against a Quality Assurance standard for compliance by state and local entities through contracting mechanisms are not existent.
- Definition of authoritative sources and appropriate stewards for data layers continues to be hampered by mandates and funding priorities.
- Higher resolution imagery is being used as an incentive to bring potential local

government and private sector partners to the table.
- Requirements for higher accuracy data and information are growing continuously.
- One size does not fit all – we need to be able to handle nested data, scales, and accuracies.
- In some areas and communities unscrupulous vendors have compromised the integrity of GIS.

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## *Data Development and Standards Goal*

*Establish an effective and efficient standards-based framework to develop, maintain, integrate, and utilize geographic data across all areas and jurisdictions in Missouri.*

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## *Data Development and Standards Strategy*

• **Adopt geographic data framework policies, standards, and best practices**
- Adopt / adapt established international, national, and state-based policies, standards, and best practices, as appropriate and incorporate within the Missouri Adaptive Enterprise Architecture. Primary focus will be given to development of a cadastral standard and LiDAR acquisition.
- Investigate and identify authoritative sources and stewards for data being developed as well as associated costs for this stewardship role.
- Investigate incentives for compliance with standards through funding requirements, quality/accuracy assessment services, and other means. This includes 'articulating the case' for standards adoption.
- Promote awareness, dissemination, use, and understanding of policies, standards, and best practices through the single MoGIS portal.
- Develop and adopt new data policies, RFP language, and best practices, as needed for building a local spatial data infrastructure within State standards.
- Utilize the Missouri Adaptive Enterprise Architecture and the policies related to it to drive state compliance.

• **Inventory and analyze current geographic data**
- Inventory statewide geospatial data assets at all levels to assess their current condition and status through the possible use of the Ramona GIS Inventory Tool of NSGIC.
- Complete the MoSDI framework profiles for each data layer using the outline provided in Appendix C. Identify the thematic and spatial accuracies of the geographic data needed to support critical business functions to include currency and completeness across the NSDI framework and Missouri's expanded data layer set.
- Complete the MoSDI framework data development plan for each target

- Publish and maintain these data development plans for each layer of geographic data outlined in the MoSDI.

• **Promote collaboration to create, document, and steward geographic data**
- Coordinate the acquisition and management of statewide geographic data and technologies that support critical business needs through development of state contracts and procurement mechanisms.
- Formally recognize the authority and responsibility of distributed producers to create and manage geographic data through MOUs, MOAs, or other such mechanisms.
- Continue development of tools and educational opportunities for compliant metadata development and submission.
- Build and develop tools and protocols for quality assessment and accuracy assessment evaluation.
- Investigate the potential that exists for standardization during a conversion process (CAD to GIS; Emergency E9-1-1 software conversion; etc.) through linkages with the vendor community.
- Develop web-based applications for local (public) information gathering and update.
- Build and make available tools and techniques for conflation of legacy data to an enhanced state (positional, attribute, or temporal).
- Provide access to, and education on, Missouri standards for geospatial data, technology, and information.

## Data Development and Standards Benefits

Automating, sharing, and leveraging geographic data provide a continuum of benefits: Using a GIS provides many benefits, sharing geographic data provides additional benefits, and participating in the framework provides even more benefits. Each level of participation offers a new set of opportunities for reducing costs, improving operations, and facilitating decision making.

- Improved communication of standards will also broaden the perspective of the larger data development community to the MoSDI goals resulting in increased versatility and accessibility.
- Common standards and guidelines provide GIS data developers with a template to use and expand, as needed, rather than developing their own from scratch.
- Provides a statewide framework consistent with federal geographic data standards and completes federal National Spatial Data Infrastructure (NSDI) foundational geographic data for Missouri.
- Builds on existing data development investments (e.g., Local, regional, and state agency initiatives).
- Standards promote improved product quality while saving time and reducing effort.
- Supports easier data sharing of geographic information in emergency

- Eliminates redundant funding for development of, and access to, the same critical geographic data.
- Data development coordinated through the MGISAC and MSDIS has yielded federally-matched funds by way of grants, joint funding agreements, and innovative partnerships, etc. to further develop the MoSDI.

## 3.5.    Goal 3: Geospatial Services

Access to, and discovery of, GIS data and services are critical for a wide variety of functions for stakeholder groups. However, many organizations lack sufficient knowledge of and/or access to GIS data and resources. This inconsistency, especially among governmental agencies at different levels, hinders the sharing and affective use of geographic data across organizational boundaries. This in turn hampers efforts to coordinate the presentation of information and the delivery of programs to the public.

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### *Geospatial Services Trends*

- Recent natural disasters (flooding and tornados) demonstrate that coordination and integration of geographic data are critical for emergency response activities. However, these applications are required to have more comprehensive and secure environments
- Demand for GIS by government agencies at all levels is increasing. "Service" models provide users and the general citizenry with access to GIS resources that don't have to be created or managed internally.
- Government agencies at all levels are consolidating IT and GIS resources, and moving forward with service oriented architecture models for distributed content management and mapping service provisions.
- The effect of the internet on speed and access within websites has driven the requirement to decrease the number of steps (or clicks) for access.
- Continued evolution of the GIS field has resulted in changes to exchange formats  (.E00 > shapefiles > geodatabases) and data delivery options.
- Movement to change the funding profile for GIS from a 'project-based' view to a 'core infrastructure' view.
- Bundling of data with metadata upon download is becoming commonplace.
- Base map web services that provide a 'Certified' foundation for mapping within and across jurisdictions are developing.
- New maps created as ArcReader and GeoPDF files with layering and query capabilities are transforming map products for general users and the public.
- Growing recognition of off-site back-up for geospatial information and data.
- Growing issues with the archival of 'old' geospatial data.
- Issues with the local use of high-resolution imagery due to transfer speeds, Internet access, and storage requirements.
- Data discovery doesn't equate to data access.

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### *Geospatial Services Goal*

*Identify, provide, and maintain a comprehensive data clearinghouse and a suite of GIS services for Missouri.*

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### *Geospatial Services Strategy*

## University of Missouri - MSDIS Clearinghouse
- Data warehouse contains statewide, regional, and local "views" of geographic data created from officially recognized distributed sources. Provides hosting, discovery, query, and distribution services for these data.
- Support GIS metadata development, maintenance, hosting, discovery, query, and distribution services.
- Develop automated processes to extract, transfer, convert, load, and integrate data into seamless and interoperable statewide and regional views.
- Coordinate and integrate geographic data for emergency response activities within MERIS' more comprehensive and secure environment.
- Aid in the development, adoption, or adaptation of web-based inventory tools such as NSGIC's GIS Inventory Tool (*Ramona*) to solicit and log information from the community on data development, status, and collaborative opportunities.
- Evaluate and recommend mechanisms to simplify and automate the data search, view, and exchange of geographic data from local sources to the state, and from the state to the Nation.
- Evaluate and recommend data delivery options and export formats for data holdings.
- Support limited GIS data development and maintenance as time and resources allow.
- Provide simple ArcReader or GeoPDF files for static or semi-static data elements as map books.
- Develop a 7.5 minute print-on-demand map series using the 'best available' data.

## Information Technology Services Division (ITSD)
## Geographic Information Office

• **Data Sharing**
- Identify, evaluate, and recommend specific data-sharing agreements for emergency and non-emergency situations.
- Identify potential supporting partnerships (such as links to federal initiatives) and identify incentives for data sharing.
- Adopt policies that encourage data sharing while addressing privacy, licensing, copyright, data-as-revenue, and legal concerns.

• **GIS Web and Application Services**
- Move forward with service oriented architecture models for distributed content management and mapping services provision. First major SOA implementation targeted is within and across the emergency response activities of the Missouri Emergency Resource Information System

(MERIS) environment.

- Develop a base map service that provides a common look and feel for all state-based Missouri web-mapping applications.
- Create and maintain a catalog of Missouri web services, tools, and applications.
- Develop and publish geospatial tools for location (geocoder), routing, drive-time analysis, and area analysis as enterprise application services.
- Develop an assessment service for local governments to 'grade' the compliance elements of a delivered or developed data set.
- As appropriate, establish web and GIS application development and hosting services to support the identified GIS services described in this document.
- Build upon existing GIS efforts of government agencies and private sector organizations.
- Facilitate integration of GIS data and applications with location-based technologies, such as wireless and traditional E-911, GPS, and address validation.

• **Core Infrastructure**

- As appropriate, coordinate the design, creation and maintenance of information technology infrastructures to support the GIS data, programs, and services described in this document – both public and confidential.
- Implement and support fail-over, back-up, and recovery for Missouri's geospatial assets.
- Identify and implement metrics that can be tracked to permit business intelligence to be gathered to support scaled development as geo-services grow and expand.
- Work to change the funding profile for GIS from a 'project-based' view to a 'core infrastructure' view.
- Implement funding schema to support replacement of old hardware.
- Evaluate and recommend a process and funding mechanism to support digital archival of old imagery and geospatial data holdings.

## *Geospatial Services Benefits*

- Access to free, public GIS data makes it possible for both private and public organizations to increase their product lines and fill new market niches at relatively small additional costs, and as a result, increase their customer / client base furthering Missouri's economy.
- Provide consumers that lack internal GIS capabilities with understanding of and access to geographic data and GIS resources and services.
- The Clearinghouse provides Missouri free, public, GIS data in one centralized location.
- The Clearinghouse by brokering data orders and fielding public questions / requests, frees participating organizations from some of their distribution and service delivery costs.
- The Clearinghouse streamlines data availability and data documentation allowing for one-stop, easy access to statewide datasets.

- Clearinghouse offers basic data, positional control, standards, guidelines, and communication forum for the broader stakeholder groups as well as individual citizens.
- Clearinghouse also provides the network of geographic data users across the state as well as links across the nation for collaboration in the development of GIS systems.
- As more organizations participate, the data pool widens, and more resource savings and operational benefits are realized.
- Coordinate and standardize agency GIS activities across state government so as to reduce duplication of data holdings and maintenance efforts. Data can be collected once and made accessible to many others who would otherwise have created their own copy or version of the same data.
- Reduces the need for federal, state, and local personnel to conduct research for sources of existing data.
- Geospatial service development via SOA aids in easing the burden of data distribution that accompany open records requests and data service requests.
- Provides a one-stop shop for GIS data and services in the State of Missouri.
- The Clearinghouse provides a majority of the 115 local Missouri counties and their respective cities with GIS data largely from federal and state agencies, thereby relieving GIS development costs.
- Citizens can access and query GIS data directly and transparently, without government interaction.

## 3.6.  Goal 4: Funding

Establishing adequate and sustainable funding will remove a significant barrier to the coordinated development, use, and maintenance of GIS resources and services across Missouri. Traditionally, GIS stakeholders have individually funded the development of their respective GIS data and systems. One of the many reasons GIS is used by agencies is because it is an efficient and effective way to deliver essential services to the public. However, GIS service activities are often not funded by the applications that use them and are viewed as support services that must be funded from external sources.

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### *Funding Trends*

- Local governments need substantial advanced notice to allow for collaboration within their budget processes.
- Several states have implemented various surcharges to be attached to land title transactions to create a funding mechanism for geospatial development within the state.
- Easy, cost-free access to geographic data has been a positive influence on economic development in many areas.
- There is a continued disparity in GIS capabilities among and within state, county, and local agencies. The disparity negatively affects the ability to deliver services in some geographic locations.
- Municipal governments have a growing need to develop GIS services complementary to those of county governments. Some municipal and county governments have needed to charge for GIS services to obtain funding for their GIS services. This can lead to license restrictions, which impede the free flow of data in emergency situations.
- State agencies have a growing need to develop GIS services that are complementary across state government and that are accessible to the public for aiding interaction.
- Current economic and political climates encourage a mix of taxes and surcharges to fund new or expanded services.
- Current Missouri state law (i.e. Senate Bill 210) allows for cost recovery but the limits of such recovery have not yet been tested.

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### *Funding Goal*

**Establish adequate and reliable funding mechanisms dedicated to the coordinated development and maintenance of GIS resources and activities in Missouri as part of the core infrastructure.**

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## *Funding Strategies*

- Establish the level of funding required and define a funding model appropriate to support the broad development and maintenance of the MoSDI.  Initial focus will be on the development of a cooperatively funded 3-year rotation for leaf-off aerial photography of the state.
- Establish the level of funding required and define a funding model appropriate for the GIO office.
- Establish a fiscal area to store/rollover collaborative funding for the GIO office.
- Explore the possibility of providing the GIO with authorization to obligate funds from the above a fiscal area.
- Evaluate the current level of funding for the State Clearinghouse and what is required to meet the goals of this Strategic Plan and define an appropriate funding model.
- Maximize the use of external funding sources by aggressively pursuing grant and other funding opportunities to support Missouri GIS goals.
- Investigate the development of actions or legislation to acquire:
    - a surcharge on cell phone use to support E-9-1-1 mapping statewide.
    - a real estate transaction-recording fee.
    - use of the State Tax Commission's Technology Fund.
    - a computer usage fee for agencies.
    - a geospatial service usage fee for agencies.
- Ensure that all expenditures of state funds supporting the development of new data infrastructures with a locale are tied to compliant outcomes.
- Build a series of testimonials (success stories) on the return on investment associated with the development of GIS data within the government and private sector. Why is it in my best interest? Who benefits? How?
- Leverage inroads made within the Homeland Security arena for data development across the state in coordination with the RHSOCs.
- Investigate possible cost models for providing off-site back-up for counties and municipalities.
- Implement funding schema to support replacement of old hardware.
- Evaluate and recommend a process and funding mechanism to support digital archival of old imagery and geospatial data holdings.

## *Funding Benefits*

- Stable, adequate funding will:
    - Enable more consistent, equitable delivery of vital services across the state.
    - Allow better planning and integration with federal funding initiatives.
    - Provide access to resources for agencies and organizations that currently lack GIS capabilities, and reduce costs associated with start-up or development of GIS applications and tools.
    - Enable agencies to make data more freely available, increasing its use and value.
- Sound funding policies will promote standardization, strengthen accountability, and improve delivery of GIS services.
- The expansion of GIS services and technologies has not only benefited

functions traditionally associated with geographic information but also has brought benefits to other institutions and the general public.

## 3.7. Goal 5: Communication and Outreach

The use of GIS and its supporting technology is rapidly growing and at the same time continually changing. As a result, many decision-makers are unaware of the potential uses, benefits, new data, and improved decision making that can be realized by incorporating GIS into their organization. Across Missouri, there is an immediate need to provide leaders and decision-makers with an increased awareness of the concepts, capabilities, and benefits of GIS.

In 2004 the U.S. Department of Labor identified Geospatial Technologies as one of three targeted and evolving technology fields in the Nation. The other two were nanotechnology and biotechnology, both of which are frequently heard about in the news. In both the public and private sectors in Missouri, there is a growing need for employees with solid education, training, and skills in GIS and its associated technologies of GPS and remote sensing. Missouri needs to develop a robust communication and outreach plan to reach, develop, support and catalyze this potential.
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### *Communication and Outreach Trends*
- GIS is becoming increasingly important for the delivery of services, and the general public is routinely using GIS on a daily basis.
- GIS training is available through a variety of organizations, including educational institutions, public and private employers, and software vendors.
- GIS education is expanding to more 2-year and 4-year colleges and universities within the state. GIS Day events take the geospatial message to an even broader audience in K-12.
- State and MAGIC Regional GIS Symposiums continue to be well attended.
- There is a growing need for more informational resources across the GIS community.
- There has been some growth of regional GIS users groups for peer-to-peer communication and networking.
- The GIS community is becoming more familiarized with RSS feeds, list serves, Wiki sites, webcasts, and other forms of communication.
- The development of a Geospatial Extension Specialist position within the Extension division of land-grant universities holds promise.
- Recognizing that outreach is not a one-way but two-way exchange.

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### *Communication & Outreach Goal*

**Increase awareness, knowledge, and expertise in the value, development, stewardship, and uses of geographic information, technology, and services.**

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## *Communication and Outreach Strategies*

- Develop and design a single Missouri GIS portal through which access to all geospatial outreach, resources, standards, data, activities, services, and opportunities can be accessed for the State of Missouri. Inform and educate existing GIS users in Missouri through a functional resource file system and contact listing – concept of 'GIO's Filing Cabinet.'
- MGISAC will communicate statewide goals and programs to the various stakeholder groups; recommend policies for data standards, sharing, security, funding, and services; serve as an advisory body to the State's Chief Information Officer (CIO), the MSDIS, and GIO; ensure that minutes of subcommittee meetings are posted; and facilitate discussion and information exchange with federal agencies.
- Develop a 'mailing list' for interaction with Missouri's broad user community that is maintained and comprehensive with contact information.
- Support and expand the regionalization efforts within the MGISAC, RPCs, Users Groups, and Homeland Security initiatives to create more opportunities for affordable, local technical and technology workshops and training across the state.
- Identify champions, groups, and organizations that would benefit from GIS education and training and develop resources to provide this learning experience.
- Leverage developing relationships with other state associations and societies to participate in their conferences, workshops, and other venues to educate and inform these stakeholder groups at their own annual meetings.
- Create opportunities for Missouri's rural governments to become engaged, supported, and more capable to utilize these technologies. The 'How To' guide developed under this *50 States* grant is one example.
- Emphasize partnership activities that should be conveyed using broad, understandable messages that highlight outcomes of the various partnership activities.
- Seek opportunities to engage decision makers at the legislative level (Freshman Tour), county commissioner, agency director, and other levels, to increase awareness, understanding, and support of MoSDI requirements and benefits.
- Evaluate and recommend the use of various technologies to reach the state and its broad user community (webcasts, user forums, regional workshops, etc.)
- Create modules on use and development of GIS and associated technologies for use as Continuing Education Credits for such groups as mappers, surveyors, planners, and others with certification processes.
- Encourage better coordination of GIS educational offerings and internships at all four-year campuses and involve Missouri's vocational - technical college and high school systems.
- Initiate formal membership agreements with organizations that have voluntarily decided to join the MGISAC.


## *Communication and Outreach Benefits*

- Engage the Missouri GIS Advisory Committee in outreach activities.
- An outreach plan will raise awareness and understanding by informing people about the Missouri GIS Strategic Plan, its goals and benefits.
- Increased awareness will improve delivery of services through wider use of GIS technology.
- Citizens will be able to make better decisions about public policy and will be able to plan for and respond to emergency situations through the use of GIS services.
- Inform potential stakeholders of the MoSDI, including state agencies, public service providers, first responders, state legislators and local elected officials.
- Encourage partnership with Missouri geospatial initiatives to increase the effectiveness of MoSDI development and implementation.
- Remain engaged in state, multi-state, federal, and international discussions on geospatial issues and policies.
- An educated and skilled GIS workforce can improve the economy by attracting businesses to the state and will make government and business more efficient.
- Create opportunities for people to be involved in the groups, activities, and planning of the MoSDI.
- Motivate cooperating agencies, stakeholders, and the public as partners in producing a communication and outreach outcomes that would be relevant and acceptable.
- Creates two-way communication to establish and foster mutual understanding, promote involvement, and influence behaviors, attitudes and action with the goal of improving the MoSDI and activities of the MGISAC and GIO Office.
- Generate support for the implementation of the MoSDI as well as GIO and MGISAC projects and programs.
- Specific advocacy with decision makers is developed by articulating the needs of geospatial users and providing strategic solutions for addressing those needs; promoting specific capacity building initiatives; and promoting community successes and other user initiatives.

# Conclusions and Next Steps

The residents of Missouri deserve the best possible delivery of geographic information services at the lowest costs. The use of GIS assists in those efforts. However, in order to maximize these benefits, the state must approach the use of GIS in a thoughtful, organized fashion. *Mapping Missouri's Future* describes an approach that emphasizes collaboration to achieve five goals that, when achieved, will make people safer, enhance economic development, protect the environment, and improve government.

*Mapping Missouri's Future* provides a roadmap to effectively meet Missouri's geospatial data needs. It portrays a comprehensive assessment of those needs, identifies financial and organizational challenges, and recommends implementation strategies. The Missouri Geographic Information Systems Advisory Committee endorses this document as an appropriate plan to guide future policies and investment decisions related to GIS by Missouri's state, regional and local governments.

As a strategic plan, *Mapping Missouri's Future* represents a beginning, not an end. Ideally, its recommendations will be implemented, resulting in satisfaction of many of Missouri's most pressing geospatial data and technology needs. But even the best of plans are rarely implemented in their entirety. Moreover, circumstances and needs change over time. Economic conditions that have resulted in staff reductions, organizational restructuring, and reduced public expenditures, in particular, are likely to affect implementation strategies identified in this document. In endorsing *Mapping Missouri's Future*, the GIO and MGISAC recognizes the need to continually monitor progress against its goals and the need to periodically review and adjust the plan.

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*Tactical Next Steps*

**Short-Term**
The GIO and MGISAC will either continue or initiate the following actions and activities during 2008 through the end of June 2009, when the state's 2009 fiscal year ends.

• Submit *Mapping Missouri's Future* to appropriate federal authorities as Missouri's Strategic Plan for Geospatial Technologies.
• Continue expansion of the Missouri Geographic Information System Advisory Committee (MGISAC); a broadly representative body whose purpose will be to provide a forum for geographic technology leadership in Missouri. Identify champions, groups, and organizations that would be appropriate members and allies in achieving the goals of *Mapping Missouri's Future*.
• Work with Missouri's Office of Administration to prepare and seek support for organizational change and budget initiatives that address issues identified in *Mapping Missouri's Future.* This would include:
    • Defining roles and responsibilities within the geospatial organizational structure.
    • Establish the level of funding required and funding model appropriate to support

the broad development and maintenance of the MoSDI.

- Establish the level of funding required and define a funding model appropriate for the Missouri GIO office.
- Evaluate the current funding level for MSDIS and what is required to meet the goals of this Strategic Plan and define an appropriate funding model.

- Establish a single "Missouri GIS Portal" to inform and support both the public and the GIS community in the: discovery, acquisition, use, and management of geographic data; geo-based information, activities, resources, and standards; GIS services, tools, and applications; and collaborations and partnership opportunities. Inform and educate existing GIS users in Missouri through a functional resource file system and contact listing – concept of 'GIO's Filing Cabinet.'
- Work to develop guidance and templates for data sharing and liability statements through more authoritative legal opinions with regard to Missouri's Sunshine Law and cost recovery statutes. Identify, evaluate, and recommend specific data-sharing agreements for emergency situations.
- Adopt / adapt established international, national, and state-based policies, best practices, and standards, as appropriate. Utilize the Missouri Adaptive Enterprise Architecture and the policies related to it to drive state compliance. *Primary focus will be given to development of a cadastral standard and LiDAR acquisition.*
- Inventory statewide geospatial data assets at all levels to assess their current condition and status through the possible use of the NSGIC's GIS Inventory Tool (*Ramona*).
- Complete Data Development Plans for 5 targeted MoSDI framework data themes. This will include completing their MoSDI framework profiles (Appendix C). *Initial targeted MoSDI layers are: cadastral, LiDAR (elevation), orthoimagery, structures, and point address.*
- Complete the MoSDI framework data development plan for each target layer. Prioritize critical geographic data gaps and develop plans to build, acquire, or enhance these data. To include appropriate standards, funding mechanisms and approaches, and business case development.
- Move forward with service oriented architecture (SOA) models for distributed content management and mapping services provision. Implement and support fail-over, backup, and recovery for Missouri's geospatial assets. Identify and implement metrics that can be tracked to support scaled development as geo-services grow and expand. *First major SOA implementation target is the Missouri Emergency Resource Information System (MERIS) environment. This will include coordinating and integrating geographic data for emergency response activities within a secure environment.*
- Support and expand the regionalization efforts within the MGISAC, RPCs, Users Groups, and Homeland Security initiatives to create more opportunities for affordable, local technical and technology workshops and training.
- Conduct outreach to refine and build support for the MoSDI vision, including making presentations at the stakeholder conferences and using the Missouri GIS Portal website to post information and promote feedback. Support initiatives and activities of organizations that address the data needs identified in *Mapping Missouri's Future* and which are consistent with its recommendations regarding organization, responsibilities, and policies.

- Monitor progress made towards achieving the goals identified within the completed data plans and revise *Mapping Missouri's Future* to reflect that progress.

**6.2 Mid-Term**
The GIO and the MGISAC should plan to continue or initiate the following actions and activities during the period between July 1, 2009 and June 30, 2010.

- Thoroughly assess progress made towards achieving the goals identified in *Mapping Missouri's Future* and implementing its recommendations and, if appropriate, recommend additional elements. Monitor progress made towards achieving the goals identified within the completed data plans. Revise *Mapping Missouri's Future* so that it reflects progress made.
- Refine and seek continued support for organizational change and budget initiatives that address issues identified in *Mapping Missouri's Future*. Work to establish via Executive Order or legislatively, a dedicated Missouri Geographic Information Officer position (with funding and budget line) within Missouri State government to serve as the lead point of contact for geospatial coordination for the state.
- Development of a list of geospatial champions and stakeholder groups for pro-active development of strategic alliances and partnerships to move forward on the critical issues, priorities, and programs important to geospatial development and implementation. This includes a geospatial contact listing for all entities utilizing or developing data as well as data portals or services. Initiate formal membership agreements with organizations that have voluntarily decided to join the MGISAC.
- Development or implementation of a tool whereby opportunities for collaboration, partnership, or coordination can be discovered and leveraged.
- Complete Data Development Plans for 6 remaining MoSDI framework data themes. This will include completing their MoSDI framework profiles (Appendix C). Investigate and identify authoritative sources and stewards for these data as well as associated costs for this stewardship role. Prioritize critical geographic data gaps and develop plans to build, acquire, or enhance these data. To include appropriate standards, funding mechanisms and approaches, and business case development.
- Review and evaluate the potential that exists for standardization during conversion processes (CAD to GIS; Emergency E9-1-1 software conversion; etc.) through linkages with the vendor community.
- Evaluate and recommend mechanisms to simplify and automate data search, visualization, and exchange of geographic data from local sources to the state, and from the state to the Nation. Develop automated processes to extract, transfer, convert, load, and integrate data into seamless and interoperable statewide and regional views. Provide simple ArcReader or GeoPDF files for static or semi-static data elements as map books.
- Evaluate and recommend data delivery options and export formats for data holdings. Develop automated processes to extract, transfer, convert, load, and integrate data into seamless and interoperable statewide and regional views.
- Develop a base map service that provides a common look and feel for all state-based Missouri web-mapping applications. Create and maintain a catalog of this

and other Missouri web services, tools, and applications. This may include such elements as geospatial tools for location (geocoder), routing, drive-time analysis, areal analysis, or a web-based application for local (public) information data gathering and update.

- As appropriate, coordinate the design, creation and maintenance of information technology infrastructures to support the GIS data, programs, and services described in *Mapping Missouri's Future* – both public and confidential.
- Seek federal funding to meet Missouri's geospatial data needs based upon the needs identified by *Mapping Missouri's Future*.  Aggressively pursue grant and other funding opportunities to support Missouri GIS goals. Leverage inroads made within the Homeland Security arena for data development across the state in coordination with the RHSOCs. Establish a fiscal area to store/rollover collaborative funding for the GIO office.
- Build a series of testimonials (success stories) on the return on investment associated with the development of GIS data for specific business applications within government and the private sector. Why is it in my best interest? Who benefits? How?  This may include an evaluation of a cost model for providing off-site backup for counties and municipalities.
- Continue to conduct outreach to refine and build support for the MoSDI vision. Evaluate and recommend the use of various technologies to reach the state and its broad user community (webcasts, user forums, regional workshops, etc.) Leverage developing relationships with other state associations and societies to participate in their conferences, workshops, and other venues to educate and inform these stakeholder groups at their own annual meetings. Create opportunities for Missouri's rural governments to become engaged, supported, and more capable to utilize these technologies.

### 6.3 Long-Term
The GIO and the MGISAC should plan to continue or initiate the following actions and activities during the period between July 1, 2010 and June 30, 2011 to ensure the effective implementation of the MoSDI vision and the sustained maintenance and operation of its components.

- Continue to assess progress made towards implementing an effective MoSDI and make recommendations about investments, policies, procedures, and organizational roles needed to ensure the sustainability of effective support for GIS within Missouri.
- Continue to monitor Missouri's geospatial data needs and, if appropriate, recommend that additional thematic Data Development Plans be developed.
- Review and revise these strategic planning documents that guide development and implementation of the MoSDI.  Revise *Mapping Missouri's Future* so that it reflects progress made towards meeting Missouri's data needs, newly identified data needs, organizational and policy changes that have occurred, and to adjust the implementation plan. Continue to seek federal and State funding to meeting Missouri's geospatial data needs based upon the needs identified by *Mapping Missouri's Future*.
- Continue to develop, expand, and formalize relationships with regional planning councils, universities, state associations, regional homeland security oversight

- Coordinate GIS and associated technology vendor product licensing, contracts, consulting services, purchasing, etc. to include standardized processes and templates for GIS related RFPs, MOUs, and contracts. These new data policies, RFP language, and best practices, need to be available to local government for building their local spatial data infrastructure within State standards. Investigate incentives for compliance with standards through funding requirements, quality/accuracy assessment services, and other means.
- As appropriate, establish web and GIS application development and hosting services to support the identified GIS services described in this document. Build and develop tools and protocols for: quality assessment and accuracy assessment evaluation; conflation of legacy data to an enhanced state (positional, attribute, or temporal); web-based assessment for local governments to 'grade' the compliance elements of a delivered or developed data set; and to facilitate integration of GIS data and applications with location-based technologies, such as wireless and traditional E-911, GPS, and address validation.
- Focus attention on the issues surrounding archival of 'old' geospatial data as well as schema to support replacement of old hardware. Work to change the funding profile for GIS from a 'project-based' view to a 'core infrastructure' view.
- Investigate the development of actions or legislation to acquire new base funding for state and local government funding of GIS through these potential mechanisms: 1) a surcharge on cell phone use to support E-9-1-1 mapping statewide; 2) a real estate transaction-recording fee; 3) use of the State Tax Commission's Technology Fund, 4) a computer usage fee or, 5) a fee-for-service to agencies. Work to designate the use of any of these fund sources to support specific geospatial activities.
- Create modules on use and development of GIS and associated technologies for use as Continuing Education Credits for such groups as mappers, surveyors, planners, and others with certification processes.
- Encourage better coordination of GIS educational offerings and internships at all four-year campuses and involve Missouri's vocational - technical college and high school systems to create the workforce for our future.
- Review geospatially related policy and budget initiatives developed for legislative sessions and seek support for them when they are consistent with recommendations made by *Mapping Missouri's Future*. This may include the establishment of stakeholder groups to review state projects greater than $200,000 to evaluate geospatial aspects, opportunities, and possible duplication or overlap. Investigate incentives for compliance with standards through funding requirements. Explore the possibility of providing the GIO with authorization to obligate funds.

## Appendix A: Web-Based Questionnaire Administered

## Missouri GIS Strategic Planning Priorities

### 1. You could best classify my employment position as:

| | |
|---|---|
| Local Government | |
| Academic | |
| Commercial | |
| Private | |
| Federal | |
| State | |
| Other (please specify) | |

**2. A major role of Missouri's Geographic Information Officer and the MGISAC is to champion important state and local geospatial initiatives – please rank the following potential initiatives in importance to you and / or your employers. Priority rank each initiative, one number per initiative, that are most important to least important.**

| | High #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | Low #9 |
|---|---|---|---|---|---|---|---|---|---|
| Funding - Grants or fiscal initiatives to support GIS development, implementation, maintenance, or enhancement. | | | | | | | | | |
| Coordination - A plan for collaboration and partnership development that justifies GIS implementation to decision makers. | | | | | | | | | |
| Technical Support - Assistance in developing geospatial applications (digital e-911, addressing, assessment, web services, etc…). | | | | | | | | | |
| Standards - With stakeholder input - develop, draft for comment, and implement useful geospatial standards(Cadastral, Addressing etc…). | | | | | | | | | |
| Data - Develop new and enhanced seamless data layers (addresses, structures, imagery, etc…) - useful to the broad geospatial community. | | | | | | | | | |
| Technical Staff Skills – Design and facilitate technical training and workshops. | | | | | | | | | |
| Management or Geospatial Data Consumer Skills – How to effectively use GIS within decision making. | | | | | | | | | |
| Implementing a GIS – A Cookbook of best practices, examples, and success stories. | | | | | | | | | |
| Data Redundancy / Backup – Protecting your data in the event of a major site failure or disaster (Greenburg, KS). | | | | | | | | | |
| Other comments (please specify) | | | | | | | | | |

**3. Keeping in mind that the Missouri GIS Advisory Committee (MGISAC) is entirely composed of volunteers - please rank the effectiveness of the Committee's activities listed below:**

| | Highly effective | Effective | Somewhat effective | Not effective | I don't know enough. |
|---|---|---|---|---|---|
| Stakeholder representation - Do you feel MGISAC has represented you? | | | | | |
| State data clearinghouse (MSDIS)- Is it helpful? | | | | | |
| Data development - Imagery for the State, etc… | | | | | |
| Funding and Grants - 50 States grant, CAP grants, etc… | | | | | |
| Homeland Security / Emergency Management - Federal/State HS Funding, Flood Plain Modernization, etc… | | | | | |
| Local Government - Regional workshops, LGov web page, etc… | | | | | |
| Outreach & Education - Conferences, workshops, list serves, etc… | | | | | |
| Strategic Planning - These meetings and existing plan. | | | | | |
| Additional comments(please specify) | | | | | |

**4. Rank the following 10 components by their importance in achieving a comprehensive and improved local spatial data infrastructure.**

| | Highest | | Average | | Lowest |
|---|---|---|---|---|---|
| Fiscal Resources | | | | | |
| Data Development, Maintenance, and Integration | | | | | |
| Human Resources | | | | | |
| Data Clearinghouse | | | | | |
| Executive Level Support | | | | | |
| Outreach / Education / Training | | | | | |
| Technology & Web Services | | | | | |
| Legislation / Policy | | | | | |
| Standards Development & Adoption | | | | | |
| Coordination and Partnerships | | | | | |
| Other important factors and your ranking of that factor (please specify) | | | | | |

**5. Rank the level of importance for each of the following issues that Missouri's Geographic Information Officer (GIO) should pay attention to:**

| | Highest #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | Lowest #12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Collaboration / Partnerships / Coordination | | | | | | | | | | | | |
| Budget /Financial | | | | | | | | | | | | |
| Guidance / Vision / Direction | | | | | | | | | | | | |
| Data Development, Maintenance & Integration | | | | | | | | | | | | |
| Clearinghouse / Data Access | | | | | | | | | | | | |
| Legislation | | | | | | | | | | | | |
| Standards development and implementation | | | | | | | | | | | | |
| Projects & Applications | | | | | | | | | | | | |
| Web-based Geo-Services | | | | | | | | | | | | |
| Enterprise-based Solutions | | | | | | | | | | | | |
| Interoperability | | | | | | | | | | | | |
| Training | | | | | | | | | | | | |
| Other priority issues to pay attention to (please specify) | | | | | | | | | | | | |

**6. Rank the following Outreach, Education and Training activities / services in order of importance to you and / or your employers.**

| | Highest | | Average | | Lowest | Don't use |
|---|---|---|---|---|---|---|
| GIS Intro & Advanced Training | | | | | | |
| GIS List Servers (msdis-news, usergroups, etc…) | | | | | | |
| Regional Planning Commission Technical Staff | | | | | | |
| Missouri GIS Conference | | | | | | |
| MAGIC Symposium (usually Kansas City) | | | | | | |
| Regional Workshops / Seminars | | | | | | |
| Other (please specify) | | | | | | |

**7. Rate the following data issues in order of importance to you and/or your employers.**

| | Highest | | Average | | Lowest | Don't know |
|---|---|---|---|---|---|---|
| Spatial / Thematic Accuracy | | | | | | |
| Currentness | | | | | | |
| Completeness | | | | | | |
| Data Sharing Guidelines | | | | | | |
| Data Analysis | | | | | | |
| Stewardship | | | | | | |
| Liability | | | | | | |
| Cost Recovery | | | | | | |
| Metadata development | | | | | | |
| Establishing database schemas | | | | | | |
| Establishing State / Federal standards | | | | | | |
| Access / Discoverability | | | | | | |
| Other data issues…(please specify) | | | | | | |

**8. Please rank, by priority, the importance of developing the data layers below.**

| | Highest #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | #12 | #13 | Lowest #14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elevation (LIDAR) | | | | | | | | | | | | | | |
| Hydrography (WATER) | | | | | | | | | | | | | | |
| Horizontal & vertical control | | | | | | | | | | | | | | |
| Cadastral (parcels / ownership) | | | | | | | | | | | | | | |
| Transportation | | | | | | | | | | | | | | |
| Governmental units (legislative, school, and tax districts) | | | | | | | | | | | | | | |
| Orthoimagery / photography | | | | | | | | | | | | | | |
| Structures | | | | | | | | | | | | | | |
| Addressable street centerlines | | | | | | | | | | | | | | |
| Addresses - point based | | | | | | | | | | | | | | |
| Land Cover | | | | | | | | | | | | | | |
| Soils | | | | | | | | | | | | | | |
| Telecommunications | | | | | | | | | | | | | | |
| Utilities (Electric, gas) | | | | | | | | | | | | | | |
| Other data layers with priority rank (please specify) | | | | | | | | | | | | | | |

**9. Rank the following technology issues - by their importance to you and/or your employers.**

| | Highest | | Average | | Lowest | Not Applicable |
|---|---|---|---|---|---|---|
| Networking / Bandwidth | | | | | | |
| Global Positioning Systems (GPS) | | | | | | |
| Software / Hardware / Peripherals | | | | | | |
| Cartographic production (maps) | | | | | | |
| Interoperability | | | | | | |
| Duplication of effort | | | | | | |
| Internet / Intranet Geo Web Services | | | | | | |
| Field deployment | | | | | | |
| Application development | | | | | | |
| Staff knowledge | | | | | | |
| Standards | | | | | | |
| Data backup | | | | | | |
| Ease of use / transparency to user | | | | | | |
| Other technology issues (please specify) | | | | | | |

**10. Rank the following resource issues by their importance to you and/or your employers.**

| | Highest | | Average | | Lowest |
|---|---|---|---|---|---|
| Retaining / Recruiting GIS experience | | | | | |
| Application programming | | | | | |
| Web programing | | | | | |
| Database administration | | | | | |
| Data development | | | | | |
| Training | | | | | |
| Facilities | | | | | |
| Funding | | | | | |
| Policy support | | | | | |
| Data storage | | | | | |
| Other resource based issue (please specify) | | | | | |

# Appendix B: Geospatial Integration Maturity Model (GIMM)

## Introduction

Geospatial information and technologies interact and impact at multiple levels within each reference model. As well, each organization is currently in a different phase of integrating Geospatial technologies, services, and data into their business operations. This initial draft of a **Geospatial Integration Maturity Model** (GIMM) is to serve as a broad, outcomes-based assessment tool. The maturity model described in this section combines activities and experiences from all sectors (federal, state, local, tribal, and private) into a single assessment forum for organizational assessment of geospatial integration.

The GIMM helps states measure their overall level of geospatial integration and provides the ability to assess improvements based on the maturity model for architecting these technologies and services to achieve their objectives and measure their contribution to agency performance.

The performance categories for the GIMM arise from the broad geospatial community as it has evolved to try to monitor these same areas. Many of these approaches related to a single categorical element such as '*coordination'* and the National States Geographic Information Council's (NSGIC) _Coordination Model_. This categorization and associated development of specific metrics needs to evolve as this model is applied, reviewed, and refined.

The categories of interest include:

- _Coordination_ —The level of facilitation, coordination, and collaboration in place regarding geospatial leadership for an organization.
- _Governance, Management, & Planning_ — The existence and evolution of plans and strategies for developing or leveraging the geospatial components of their business data.
- _Data Acquisition, Documentation, & Maintenance_ —The stage of implementation regarding geospatial data lifecycle processes such as development, documentation, and maintenance.
- _Standards & Best Practices_ —The level of adoption and compliance with geospatial technology and process standards related to their business drivers.
- _Data Access & Distribution_ —The existence and continuing development of geospatial data holdings, their discoverability, searchability, and accessability.
- _Policies & Compliance_ —The development and use of compliance –based processes for assessing consistency of integration, adoption, and service implementation for geospatial technologies, data, and services.
- _Enterprise Integration_ —The degree to which the geospatial aspects of the business data collected by the organization are planned for, integrated, leveraged, and used to guide an organizations investments and future initiatives.
- _Training and Skills Development_ —The level at which the organization as a whole is aware, understands, and communicates the potential utility and application of geospatial technologies to achieve their mandated activities.

Performance measures should reflect a sense of prioritized achievement and should reflect both outcomes and outputs. For each GIMM category the range of possible geospatial indicators has been identified and categorized along a continuum expressed as levels 0 through 5, with *fives* equating to levels of high achievement for that category. In the early years of this GIMM assessment, agencies will not have perfect measures. This Maturity Model is not about perfect measures, but better measures that provide appropriate direction, objectives, and goals for project managers and key decision-makers.

Utilizing this *Maturity Model*, a baseline of the current state of geospatial integration within an organization can be measured and documented. Conducting this baseline analysis will allow a reference point to be set from which improvement targets can be determined and progress then measured. Once the relevant baselines are established, the next step is to use that context along with some additional information to set performance targets for each geospatial *Maturity Model* category identified. Performance targets will need to be quantifiable estimates or expected results bound to a given time period. It is against these targets that any performance improvement will be measured. Improvement strategies may span or affect any or all of the areas of the *Maturity Model*. The improvement targets set against each relevant indicator then serves as the measuring stick for progress on these various fronts. Once collected the performance information facilitated by the *Maturity Model* can be used in targeted circumstances to drive more rigorous analysis to support decision-making. The important point is to use the information provided by progress towards *Maturity Model* goals to make better decisions, and as necessary, assess and re-assess the organization's path forward.

## Geospatial Integration Maturity Model: General Maturity Levels

### Level 0—No Program

There is not a documented geospatial integration profile in place at this level of maturity. While geospatial solutions are developed and implemented, this is done with no recognized use of standards or base practices. The organization is completely reliant on the knowledge of individual geospatial specialists.

### Level 1—Informal Program

The base geospatial architecture framework and standards have been identified but are typically performed informally. There is general consensus that these steps should be performed, however they may not be followed and are not tracked. Organizations with a geospatial integration profile at this level are still dependant on the knowledge of individual geospatial specialists.

### Level 2—Repeatable Program

The base geospatial architecture and standards have been defined and are being tracked and verified along business lines. At this point in the program, geospatial processes are repeatable and reusable templates and components are starting to be developed. The need for product and compliance components to conform to the standards and requirements has been agreed upon, and metrics are being developed and used to track progress toward integration goals and objectives.

### Level 3—Well-Defined Program

The geospatial enterprise architecture profile is well defined; using approved standards and/or customized versions of processes or templates. Geospatial processes and services are documented across the organization. Performance metrics are being tracked and monitored in relationship to other general practices and business lines.

### Level 4—Managed Program

At this point performance metrics are collected, analyzed and acted upon. The metrics are used to predict performance and provide better understanding of the geospatial processes and capabilities and their impact on the lines of business and the organizations mandated activities.

### Level 5—Continuously Improving Vital Program

The geospatial processes are mature; targets have been set for effectiveness and efficiency based on business and technical goals. There is continued diligence on operational aspects of the geospatial integration of the organization but the organization's context within the larger national geospatial framework is understood and pursued. There are ongoing refinements and improvements based on the understanding of the impact that changes in these technologies have on these geospatial processes and programs.

## Geospatial Integration Maturity Model Categories

### Coordination

### Level 0

No Geospatial Coordination is in place. Geospatial Information Technology is viewed as a project element and activities are pursued and conducted independently by various individuals, agencies, organizations, and government sectors on a project-by-project basis.

### Level 1

Project-based Coordination wherein independent groups recognize or share a common need where the development of spatial information is a common goal. A vested leader for the group emerges to push the project along and perform the coordination necessary to achieve the desired goal. Once completed, the group dissolves and independence is once more the norm.

### Level 2

Volunteer Coordination relies on an individual to take the lead for the integration of geospatial technologies or where the development of spatial information is a common goal. This leader performs the coordination necessary to move the organization to the desired goal. In many cases this coordination occurs with no predictable pattern or frequency as the volunteer has no time or latitude for such activity.

### Level 3

Unofficial Single Department Coordination: This coordination model can be effective, but it is generally dependent on key individuals who have received their department's blessing to conduct these activities. Being vested within a specific department can also bring perspectives more narrowly defined than are necessary for effective enterprise geospatial coordination. The likelihood that this level of facilitation and coordination will be maintained when that person leaves or when there is a change in leadership within the organization, is very low.

### Level 4

Official Coordination through a Geospatial Information Officer (GIO): This method of coordination has become increasingly popular and is generally most effective. This model provides the greatest assurance that required enterprise coordination work will be identified and completed to the extent granted by the authorizing mandate. Many offices are not always empowered to address all of the required issues so care must be taken in the development of the language establishing its authority.

Coordination roles and responsibilities may include: Assessing needs and identifying geospatial investment priorities; Ensuring cost efficient and open access to spatial data and technology resources; Establishing appropriate data standards and ensuring compliance; Establishing appropriate data access and sharing policies; Coordinating data production, maintenance, documentation and delivery; Establishing Mapping Services; Establishing an FGDC compliant Clearinghouse Node (data & metadata); and Coordinating the development of geospatial applications.

### Level 5

Official Coordination through a Geospatial Information Officer (GIO): Coordination roles and responsibilities are reviewed and updated, such functions may include: extended coordination functions outside of the resident agency between federal, state and local agencies; Establishing and maintaining budgetary authority to collect and distribute funds; Establishing and maintaining authority to form partnerships with other levels of government, non-profit organizations, utilities and private organizations; Providing a non-lapsing fund for priority data and system development projects; Providing contractual authority; Offering suitable expertise on technical, management, and policy issues.

## _Governance, Management, and Planning_

### Level 0

No plans for developing or leveraging the geospatial element of the data with the technologies are in place.

### Level 1

Need for geospatial enablement of their information holdings has been identified. Geospatial activities are informal and unstructured.

### *Level 2*

The organization has begun to develop a vision for how a geospatially enabled database structure and geospatial technologies can enhance support for the organization's business goals and objectives while providing efficiencies in business process workflow.

The organization has begun to identify geospatial elements, tasks, and related business lines and their associated resource requirements.

The organization has begun to develop a plan for their geospatial program elements to bring them to the enterprise.

### *Level 3*

Geospatial enterprise plans are well-defined and go beyond data retrieval by providing plans for analysis, interpretation, and display of information to observe relationships, patterns, or trends that were not possible to visualize with traditional charts, graphs, and spreadsheets.

Geospatial governance roles and responsibilities have been outlined.

A structured framework and timeline for developing the geospatial enterprise have been established.

Financial and staffing resource requirements have been outlined.

The geospatial enterprise activities are carried out according to the defined plan.

### *Level 4*

The geospatial plans are reviewed against business lines and programmatic mandates and changes are incorporated to improve the organization's overall enterprise program.

The organization captures metrics to measure the progress of the plan against the established geospatial goals, objectives, and task elements.

Strategic planning is taking place to set goals for future evolution of the overall Enterprise Architecture Program Plan with the geospatial being an implicit element of those discussions.

### *Level 5*

Geospatial action plans are proactively developed and implemented to increase the effectiveness of the overall Enterprise Architecture Program based on captured metrics and opportunities presented among shared business lines.

The organization works with other federal agencies, states, tribes, and local governments to share ideas with a focus on improving the national geospatial profile and framework.

## *Data Acquisition, Documentation, And Maintenance*

### *Level 0*

Information development processes and geospatial data are not documented nor are they maintained.

### *Level 1*

Geospatial data development processes are ad hoc and informal, processes followed may not be consistent among departments, maintenance processes are ad hoc and informal.

There are no unified processes or geospatial data element standards utilized across the geospatial technologies nor among the organization's lines of business.

### *Level 2*

Basic FGDC compliant geospatial metadata is collected and documented.

Data acquisition standards are utilized and processes are planned and tracked for quality assurance and quality control reporting.

The organization is beginning to employ maintenance methods for capturing and providing back-up of time-critical geospatial information elements.

### *Level 3*

The geospatial data lifecycle processes have been defined and documented for the organization to include stewardship roles and responsibilities as well as archival rules and retention.

Standardized data acquisition and development processes are being used as the foundation for other agencies, departments, etc. to ensure interoperability.

FGDC compliant geospatial metadata templates are being used to ensure that the capturing of information is consistent.

### *Level 4*

The organization routinely captures metrics to measure the effectiveness of the geospatial data development and maintenance processes against business objectives.

The organization routinely captures metrics to measure the effectiveness of the geospatial data documentation templates against business requirements.

Corrective action plans are put in place when deficiencies in templates and/or procedures are identified or as geospatial technologies evolve or sunset.

Intra-governmental meetings are held regularly to review status and goals of the mandated data development activities in relation to the NSDI Framework.

### *Level 5*

The geospatial lifecycle processes are being followed and have become second-nature within the organization.

Captured metrics are used to identify inefficiencies in data development or acquisition processes prior to notification of issues.

Organization shares with other federal, state, tribal, and local governments it's ideas for improvements to geospatial processes and templates.

Intergovernmental meetings are held regularly to review status and goals of the mandated data development activities in relation to the NSDI Framework.

## _Standards & Best Practices_

### _Level 0_

Documentation of business drivers for geospatial technology implementation are unknown.

Geospatial technology standards and best practices are unknown or not followed.

### _Level 1_

Documentation of business drivers for geospatial technology implementation are informal.

Technology standards and best practices utilized are informal and inconsistent.

### _Level 2_

Business drivers and strategic information related to geospatial elements, technologies, processes, and data have been identified.

The need for a repository for storage and dissemination of standards and best practices for geospatial information has been identified.

### _Level 3_

Use of existing geospatial technology standards is consistent within the organization.

Documentation of geospatial business drivers and strategic information leads to an inventory of needs related to standards and best practices.

### _Level 4_

Documentation of geospatial aspects of business drivers and strategic information has become a standard operating procedure.

Documentation and use of geospatial standards and best practices has become familiar within the organization.

The organization captures metrics from the compliance process to identify the need for updates to the geospatial business information, technology change's impacts on protocols, and migration / evolution strategies for implementation planning.

### Level 5

Captured business and technology information is reviewed in conjunction with the monitoring of new geospatial technology and business trends to proactively identify those technologies that will improve the national geospatial framework of data, technologies, and information.

The organization works with other federal, state, tribal, and local governments to share information regarding best practices.

The organization works with other federal, state, tribal, and local governments to share information regarding general approaches to supporting the implementation of new geospatial business and technology trends, standards, and best practices.

## _Data Access & Distribution_

### Level 0

Management and departments are not aware of what geospatial data and information is present or the benefits of knowing.

### Level 1

The need to create greater awareness about geospatial assets has been identified.

Little is known or shared about the geospatial assets or possible distribution methods and improvements.

### Level 2

The need for geospatial data discoverability is being communicated to management.

Geospatial data awareness and distribution activities are beginning to emerge or be developed.

### Level 3

The geospatial data holdings are well defined and their existence communicated.

Interagency data sharing and distribution agreements are being formulated.

Interdepartmental access and distribution activities are developed.

### Level 4

Geospatial data holdings are digitally available and searchable through an FGDC metadata clearinghouse node.

Data sharing and distribution agreements are in place to improve the communication and exchange geospatial data.

Intergovernmental access and distribution activities are developed.

The organization captures metrics to measure the extent and effectiveness of the data discoverability, access, and distribution activities.

### Level 5

Metrics are used to proactively identify opportunities for improved data services.

Geospatial data holdings are digitally available, searchable, and downloadable through an FGDC data clearinghouse node.

Extensive data sharing and distribution agreements are in place to improve the communication and exchange of geospatial data.

Intergovernmental access, distribution, and update activities are deployed.

The organization works with other federal, state, tribal, and local governments to share ideas for improvements to the national geospatial clearinghouse.

## Policies & Compliance

### Level 0

No geospatial compliance process exists within the organization. The Missouri Adaptive Enterprise Architecture (MAEA) as an organizational mandate is largely ignored.

### Level 1

The need for compliance to geospatial standards has been recognized as outlined in MAEA.

Compliance is informal and unstructured.

Compliance cannot be measured effectively because processes and procedures are not consistent across areas and/or implementations.

### Level 2

The organization has begun to organize a compliance process to ensure that all projects and business line implementations utilizing geospatial data and information are consistent with the geospatial standards adopted by the organization and outlined within MAEA.

### Level 3

A formal geospatial compliance process is well defined and is an integral part of the geospatial data lifecycle processes.

A formal geospatial compliance process is well defined and is used as a filter for the development and review of proposals for application or data development within the organization.

A waiver request and business justification is required for variance from the adopted geospatial standards.

### Level 4

Compliance to geospatial standards has become common practice throughout the organization.

Quality metrics associated with geospatial-related business cases are captured.

The geospatial compliance process is continually reviewed and updated as deficiencies or enhancements to the process are identified.

### Level 5

Information gathered during the compliance process is used to proactively identify updates to geospatial standards and/or policies.

Compliance metrics are used to drive continuous process improvements in the Business Cases as well as define opportunities for leveraging activities.

The organization works with other federal, state, tribal, and local governments to share ideas for improvements to the compliance process as it relates to the geospatial elements and technologies it embodies.

## Enterprise Integration

### Level 0

No program in place for geospatial integration across the enterprise IT environment.

### Level 1

The role that geography or location plays as a central organizing principle in a line of business has been recognized and critical data model elements have been identified.

Geospatial projects, purchases, and applications are typically developed in isolation resulting in redundant acquisitions, development, and training.

### Level 2

The need for geospatial integration to the overall enterprise architecture effort across lines of business and services has been identified.

The various touch-points between the geospatial components (technologies, standards, processes, services, analyses, etc.) and lines of business and outcomes have been mapped (however, no details exist as to how the integration will take place).

### Level 3

The geospatial aspects of the organization's architecture program is integrated with strategic planning, as well as review and approval within the budgeting process.

Touch-points of business lines and processes utilizing geospatial elements and components have been well defined to enable higher levels of information integration, analysis, and presentation.

### Level 4

The organization's enterprise architecture is used to guide geospatial development and acquisition.

The organization captures metrics to measure the savings in resources, including time and money, through the leveraged use of geospatial technologies within their data models, applications, and data base systems.

Costs and benefits of geospatial integration within the IT environment, including benefits across agency boundaries, are considered in identifying projects.

Geospatial technologies are enhancing decision-making and stream-lining business processes while adding significant analytical capabilities to the enterprise IT environment.

Geospatial integration procedures are reviewed and processes updated when problems or new functionality is identified.

## Level 5

The organization's enterprise architecture process is fully engaged with geospatial functionality that drives continual evolution of geospatial initiatives throughout the enterprise.

The organization's lines of business influence the geospatial technology deployed and the geospatial technology influences how and what can be delivered along business lines.

Captured metrics are used to proactively identify improvements to the geospatial integration processes.

The organization works with other federal, state, tribal and local governments to share ideas for improved geospatial integration, including the areas of procurement, project management practices, application development, and system administration.

## Training And Skills Development

## Level 0

There is no program in place for geospatial awareness education.

Several independent groups or individuals typically work to solve a single geospatial issue.

## Level 1

The organization has identified the need to inform staff throughout the enterprise of the benefits and concepts of a geospatially enabled enterprise architecture.

Geospatial awareness efforts are informal and inconsistent and may be met with skepticism or indifference.

## Level 2

The organization has begun to develop plans for geospatial training and educational sessions to increase the awareness and understanding of what a spatially enabled enterprise can do for the organization.

Geospatial concepts and functionalities are beginning to be introduced and more consistently discussed in normal day-to-day meetings.

## Level 3

The geospatial operations of the organization begins to operate as a team, using the defined architecture program and adopted / adapted geospatial standards.

Management briefings have occurred to inform and create champions for the geospatial integration efforts.

Both business and technical staff understand and promote the appropriate use of geospatial technologies in addressing needs and requirements for the lines of business mandated by the organization.

## Level 4

Personnel throughout the organization have a good understanding of the geospatial principals and can utilize and develop projects to leverage this aspect of their data across the enterprise.

The organization captures metrics to measure the awareness, participation, acceptance and satisfaction with the geospatial integration effort.

## Level 5

Cross-agency personnel work together as contributors to the spatially enabled architecture and its shared services.

The organization uses the captured metrics to proactively create action plans for the further expansion of geospatial applications in the business of the organization.

The organization cooperates with other federal, state, tribal, and local governments in a peer-to-peer forum to share ideas for creating an atmosphere for active involvement, promotion, and deployment of geospatial education, information, application and service support across the national geospatial enterprise.

**Appendix C: Template for MoSDI Data Development Plans**

**Missouri Spatial Data Infrastructure Data Development Plan**
(adopted from Minnesota)

## *Theme Name*

## 1. Overview

### 1.1. Theme Description
Briefly describe the theme in terms that are easily understood by a non-technical person. Be sure to explain why this data is important by describing how the data is used, focusing upon the activities and functions that benefit Missouri. Where the theme includes data used at several scales, examples of how each is used should be identified. If this theme has been identified as an important element of the NSDI, either as framework data or projects such as The National Map, describe the relationship.

### 1.2. Plan Purpose
Describe the purpose of this document. If appropriate, adapt the following general statement so that it more completely describes the purpose of this data plan. "The purpose of this document is to identify Missouri's need for (*theme name)*, describe how this need is currently being addressed, and recommend resources, processes, organizational structures and strategies required to develop an effective Missouri Spatial Data Infrastructure."

### 1.3. Vision
Imagine that enough time has passed to implement all of the recommendations for data production, maintenance, management and distribution made by this plan. Then write a statement that describes how Missouri is meeting those needs at that point in the future.

### 1.4. Guiding Principles
Identify the principles that will guide the effort to develop and implement a plan for meeting our needs for this data. These principles should reflect the basic principles adopted for the MoSDI, but may be adapted as needed.

## 2. Importance of Theme

### 2.1. Business Needs
Identify the mandated data stewardship responsibility. Also identify the principal stakeholders who need this data, specifying activities and functions that are affected. This does not necessarily need to be an exhaustive list, but ideally is representative of all levels of government within Missouri, especially state, regional and local. If federal, nonprofit, or private stakeholders also depend on this data, identify how they use it as well. Be sure to include any issues that affect the urgency of addressing this data need.

### 2.2. Benefits
Identify and describe, as best you can, specific benefits that will result from meeting the goals of this plan. Do not focus on general statements of benefit unless they are

accompanied by some quantifiable estimate, such as cost savings, increased productivity, improved response time, reduced risk, minimized environmental damage, etc. Where appropriate, include examples that represent statewide, regional and local uses.

**2.3. Business Impacts**

Describe any changes to current business practices that are likely to occur if the goals of this plan are met, focusing especially upon how they may be reflected in changes in processes, organizational structure, or relationships among organizations. These impacts may include results that are less quantifiable than those discussed in section 2.2. For example, the shifting of responsibility for acquiring and managing a data type that had previously been independently acquired and managed by many units of government to a single organization.

# 3. The Data Environment

### 3.1. Data Description

Describe the data that is needed in as much detail as possible, identifying characteristics such as scale, resolution, positional accuracy, frequency of update and any other characteristics that affect the suitability of the data to meet the business needs identified for the business cases noted within the theme description.

### 3.2. Data Priorities

Where meeting the business needs associated with this data theme requires several different datasets, distinguished by characteristics such as scale, resolution, accuracy, frequency of update or appropriate, identify the relative priorities for each. Priorities should reflect the projected benefits to Missouri resulting from addressing the business needs.

### 3.3. Data Sources

Identify the principal sources for the subject data theme. Where more than one type of data, distinguished by characteristics such as scale, resolution, accuracy, frequency of update or appropriate, identify the sources for each type.

### 3.4. Data Standards

Identify all standards related to this theme, whether or not they have been adopted or implemented within Missouri. Identify all organizations that have made formal commitments to using the standards or promoting their use. If the standards are still being developed and reviewed, as is the case with many national standards, describe how Missouri plans to participate in the process. When identifying standards, be explicit about their name, adopting organization and cite references for further information.

# 4. What's Being Done

Describe what already has been done to meet the needs for development or maintenance of this data theme. Where possible, distinguish among statewide, regional and local solutions. Also denote what has been accomplished within other technologies such as CAD, surveying, etc.  For each of the categories of data associated with this theme, identify data that already exists. For each dataset, identify or describe the following:

- producing organization
- geographic coverage

- coordinate system
- positional accuracy
- standard(s) followed
- completion date
- maintenance cycle
- distribution policies

## 5. Funding

**5.1. Estimated Total Investments in Theme**
Identify the total investment that will have been made through the end of 2007 to develop and maintain each class of data covered by this them. Estimate investments made by local, regional, state, and federal units of government. If appropriate, investments made by other sectors also should be identified.
**5.2. Costs for Developing First Iteration of Theme**
Estimate the one-time development costs for completing the theme.
**5.3. Maintenance Costs**
Estimate the costs for maintaining the data once it has been developed. If data must be newly acquired on a periodic schedule to meet identified business needs, identify the cycle and the projected costs. Describe the update requirements for the data, addressing whether the data is updated through transactions, through periodic changes, or completely replaced when changed. Identify the current update cycle and the responsible party for updates. If no update strategy currently exists, or if changes are appropriate, recommend procedures and the responsible party for the updates. Where constraints exist, such as funding limitations, describe them.
**5.4. Current Funding Allocated**
Identify funding that is known to have been committed to developing or maintaining the data associated with this theme. Be as specific as possible about the commitments made. At a minimum, estimate investments made by local, regional, state, and federal units of government.
**5.5. Overcoming the Funding Gap**
Describe the alternative strategies for funding the development and maintenance of the data covered by this theme. The strategies should identify the funding sources and any steps required to secure them. If possible, recommend those that are appropriate for implementation. Assess opportunities for operational or programmatic funding rather than project-based funding.

## 6. Data Management and Distribution

**6.1. Data Management**
Describe how data will be managed, identifying the steward, who will be responsible for ensuring reliable data storage, and developing policies and procedures for storage and management, including backups, backups and disaster recovery.
**6.2. Data Integration**
Where aggregation or assembly of data originally produced by several organizations is required, either for regional or statewide use, identify the organizations that are recommended to assume this responsibility and assess whether or not they are currently equipped to support the activity. Where integration is not practicable, for

either technical or organizational reasons, describe the constraints and recommend how they may be overcome.

**6.3. Data Distribution**

Describe how data will be distributed, identifying where data will be stored and the policies and technologies that would be used for distribution. If fees or license agreements are likely to be used, identify them. Also, identify how the costs of management and distribution will be funded. Assess the potential for distribution via web services.

# 7. Organizational Relationships

Describe the organizational relationships and policies that will be needed to implement a solution to the data needs identified for this theme. Where explicitly assigned roles and responsibilities and formal agreements are likely to be required, they should be identified. Where it is judged that new organizations are needed or business practices need to be redesigned that affect how organizations currently conduct their business, these changes should be described.

# 8. Implementation Strategy

Describe any recommendations related to implementing actions needed to address the data needs identified for this theme. Organize the recommendations into those that should be taken within the next twelve months, within the next three years, and long-term. For each time period, distinguish among actions recommended for local, regional, state and national organizations.

**8.1. Short-Term**

Identify actions or steps that should be taken by December 31, 2008 by local, regional, state, and national organizations. This can be a bulleted list with milestones. Be aware of strategically important dates for recommendations requiring budgetary or legislative actions. Note that the legislative session that considers the next biannual state budget will begin in January 2009.

**8.2. Mid-term**

Identify actions or steps that should be taken between July 1, 2009 and June 30, 2010 by local, regional, state, and national organizations.

**8.3. Long-term**

Identify actions or steps that should be taken after July 1, 2010 by local, regional, state, and national organizations.

# 9. Data Development Team Members

Identify the people involved in the preparation of this document and the organizations they represent.